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Attorneys for Plaintiffs

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA

IN AND FOR THE COUNTY OF MARICOPA

Tonopah Community Council, STOPP Committee; Julie Park; Raul Tijerina & Brenda McBeath; Song Mun; Lorna Proper & Theron Proper; Camilla Van Sickle & William Pennington; David Dyrcz; Sonia Lopez; Oscar Lopez & Diocelina Lopez; Doris Heisler; Phyllis McEwen & Gordon McEwen; Daniel Blackson & June Blackson; Lynn Holzner & Teresa Holzner; John Teixeira; Linda Butler & Mike Butler,

Plaintiffs,

v.

Hickman's Egg Ranch, Inc.; John Does 1-10,

Defendants.

Case No.: CV 2014-091726

PLAINTIFFS' MOTION FOR TEMPORARY RESTRAINING ORDER (WITH NOTICE) OR, IN THE ALTERNATIVE, PRELIMINARY INJUNCTION

Plaintiffs hereby move this Court to enjoin the ongoing construction and pending operation of the Hickman Egg Farm (also known as Desert Pride Farm) in Tonopah, Arizona

(hereinafter the "Facility"). The instant action is based on an "anticipated nuisance." *See, McQuade v. Tucson Tiller Apartments, Ltd*, 543 P.2d 150, 153 (Ariz. App. 1975) (". . . in order to enjoin an anticipated nuisance, the nuisance must be highly probable."). As discussed herein, it is highly probable that the Facility, when operational, will present both a private and public nuisance. *See, e.g., Report of Scientists from Johns Hopkins, Bloomberg School of Public Health*. Ex. 1 at 2 ("[I]t is highly likely that the proposed Tonopah facility will . . . constitute a public nuisance and a potential health threat to members of the surrounding community."). Irreparable harm will result if the requested injunction is not granted.

The U.S. EPA defines a large concentrated animal feed operation ("CAFO") as 82,000 laying hens. 40 C.F.R. § 122.23(b)(4)((ix). The Facility will have approximately 2,200,000 (2.2 million) laying hens in its first phase of operation and will subsequently house approximately 12,000,000 (12 million) laying hens in a confined area.[1] A facility of this size will produce massive amounts of manure. Indeed, if the annual manure from an egg CAFO with 2.5 million chickens was stacked, the pile would (conservatively) be five feet high, ten feet wide, and go on for seven miles. With 8 million chickens, the manure wall would extend for 22 miles.[2]

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[1] The number of pullets, or hens that are not yet old enough to be layers, is unclear but likely significant. On information and belief, Hickman anticipates having separate pullet house(s). The manure contribution of pullets is not reflected in these calculations contained herein.

[2] Manure calculations are conservatively based on the design factors from Midwest Plan Services MWPS-18 2nd edition (2005) Manure Characteristics, Table 6, page 13. An egg

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The Facility will stink. It will also provide a breeding place for flies and mosquitos, spew feathers, manure, dander and other pollutants across boundaries through massive ventilation fans, introduce noise and truck traffic, and have myriad other significant environmental/health related impacts on the surrounding community. The Facility will destroy Plaintiffs' quiet use and enjoyment of their property. The Facility presents an anticipated nuisance that should be enjoined/abated.

I. BRIEF BACKGROUND AND FACTS

> Over the last 50 years, the method of producing food animals in the United States has changed from the extensive system of small and medium-sized farms . . . to a system of large, intensive operations where the animals are housed in large numbers in enclosed structures that resemble industrial buildings more than they do a traditional barn. That change has happened primarily out of view of consumers but has come at a cost to the environment and a negative impact on public health, rural communities, and the health and well-being of the animals themselves . . . The present system of producing food animals in the United States is not sustainable and presents an unacceptable level of risk to public health and damage to the environment . . .

Report of the Pew Commission on Industrial Farm Animal Production, *Putting Meat on the Table: Industrial Farm Animal Production in America,* p. 5 (April 29, 2008) (Excerpts included herewith as Ex. 2). According to the Pew Commission Report, "public health concerns" generally associated with these types of facilities include "heightened risks of pathogens (disease and non-disease causing) passed from animals to humans; the emergence of microbes resistant to antibiotics and antimicrobials . . . and dispersed impacts on the

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layer with average weight of 3 lbs. produces: (1) 0.002 cubic feet of manure per bird per day; (2) 0.15 lbs. of manure per bird per day; (3) 0.0026 lbs. nitrogen per bird per day.

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adjacent community at large." *Id.* at 13; *see also, e.g.*, American Public Health Association ("APHA"), "*Precautionary Moratorium on New Concentrated Animal Feed Operations*," Policy No. 20037 (11/18/2003) ("urg[ing] moratorium on new CAFOs until additional scientific data on the attendant risks to public health have been collected . . .").

A. Defendants' Egg Operations

The dilatory impacts on air, groundwater, soils, and surface waters in the vicinity of CAFOs – even those that are much smaller than the one proposed here – are well documented. Indeed, Defendants' own egg laying facilities in other locations have a significant history of problems and cross-boundary impacts – including stench, rodents and flies/mosquitoes that impact property owners miles from operations. *See*, e.g., Ex. 3. David Madrid, *Hickman's egg factory planned for Tonopah hatches riff*, Arizona Republic (February 10, 2014). Defendant admits the existence of significant problems at its Arlington location. Further, Defendant admits rodent problems at its Maricopa facility. *See*, e.g., Ex. 4, Establishment Inspection Report dated May 5, 2011 (FEI 3004335866). Mike Rowe, host of Discovery Channel's "Dirty Jobs" (who produced a show at one of Defendant's egg laying Arizona facilities in 2008) described the lower level of one of Defendant's "high rise" chicken houses as "one of the worst places I've even seen. . ." *See, Dirty Jobs*, Season 3, Episode 19. At this "high rise" chicken house, manure from chickens above continuously rained down as Mr. Rowe attempted to bulldoze the waste out of the lower level.

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B. The Hickman - Desert Pride, Tonopah Egg Facility

Defendant is constructing another, even larger CAFO, in Tonopah, Arizona. Defendant began construction of the Facility in February 2014, in an environmentally sensitive area – above geothermal hot springs and a drinking water aquifer, in close proximity to (if not in) a floodplain and abutting a series of washes that feed jurisdictional waters of the United States. The Facility is also being constructed in close proximity to preexisting residential areas, small businesses and a school – most of whom rely on water from local wells[3] that will be placed at risk of contamination and all of whom will be impacted by, *inter alia*, the smell, flies and noise of the Facility, as well as by related truck noise, emissions and traffic. Moreover, the Facility will utilize under-supervised prison labor as its primary work force. The introduction of a prison workforce into this rural community will likely, in-and-of-itself, interfere with Plaintiffs' use and enjoyment of their respective properties. i.e., be a "nuisance."

Notwithstanding the magnitude of the proposed Tonopah operation and the already well-established impacts that such facilities have on human health and the environment, Hickman has provided little information to regulatory agencies regarding any aspect of their

[3] In addition to the risk of contamination, there is also a high probability that Hickman will impact the availability of water. According to the scientists from Johns Hopkins, "the Tonopah facility poses a substantial water usage burden in area of water scarcity . . . the Tonopah facility, once in operation, would require the total use of an estimated 222 gallons per minute (for an inventory of 2 million layers) to 1,333 gallons per minute (for an inventory of 12 million layer hens) for drinking and egg wash water . . . Water withdrawals of this extent may affect yields in surrounding wells and limit water availability to other businesses and residences that rely on well water for drinking." Ex. 1 at 14.

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operations – they are constructing and proposing to operate the Facility under an "agricultural exemption."[4] Moreover, Hickman has refused to provide any substantive response to inquiries regarding the specific plan of operations at Tonopah.

Based on Hickman's own statements, however, it appears that the first phase of the Facility will accommodate 2.2 million layer hens. At full capacity, Defendant intends to have an inventory of up to 12 million chickens. Phase one also includes two open-lined pits for storing wastewater, including fluids used to clean and disinfect surfaces of eggs and effluent from washing housing interiors. These lagoons are approximately 600 feet (over a tenth of a mile) in length by 100 feet in width, covering 60,000 square feet of an area at an undisclosed depth. (Ex. 5 – site plan).

It appears that fresh manure will drop onto a manure belt below enriched colony cages, to be conveyed at regular intervals to an area where it will be dried and trucked off site. The chicken houses, including the manure drying areas, will be directly vented into the outside air by large fans. Based on an application of the conservative Midwest Plan Service MWPS-18: (1) 2.2 million layers will produce 330,000 pounds of manure per day; (2) 8 million layers will produce 1,200,000 pounds of manure per day; and (3) 12 million layers will produce 1,800,000 pounds of manure per day. *See*, nt. 1, *supra*.

[4] The propriety of the County's grant of an "agricultural exemption" to the Tonopah "agri-industrial" facility is currently being challenged in a separate, Special Action, in Maricopa County, Superior Court. CV2014-093028.

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II. STANDARD FOR GRANTING A PRELIMINARY INJUNCTION

In Arizona, a party seeking a preliminary injunction must establish: (1) a strong likelihood of success on the merits; (2) the possibility of irreparable injury if the requested relief is not granted; (3) a balance of hardships favoring that party; and (4) public policy favoring a grant of the injunction. A court applying this standard may apply a "sliding scale." That is, the moving party may establish either: (1) probable success on the merits and the possibility of irreparable injury; or (2) the presence of serious questions and that the balance of hardships tips sharply in favor of the moving party. In determining whether "serious questions" exist to support a preliminary injunction, the relevant inquiry is whether there are "serious questions going to the merits." *Arizona Association of Providers for persons with Disabilities v. State*, 223 Ariz. 6, 219 P.3d 216, ¶¶ 12-13 (App. 2009), *citing, Shoen v. Shoen*, 167 Ariz. 58, 63, 804 P.2d 787, 792 (App. 1990).

Plaintiffs' can demonstrate a strong likelihood of success on the merits and that irreparable injury is likely in the absence of an injunction. The remaining factors also weigh in favor of granting the requested injunction and abating the anticipated nuisance.

A. There is a Strong Likelihood of Success on the Merits

In order to enjoin/abate an "anticipated nuisance," the moving party must show that nuisance is "highly probable." *McQuade,* 543 P.2d at 153; *Coyote Flats, L.L.C. v. Sanborn Community Commission,* 596 N.W.2d 347, 352-354 (1999) (Holding that proposed swine CAFO was an anticipated nuisance because it would inevitably produce noxious odors, increase truck traffic that would damage roads, and impact land values); *see also, Armory*

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Park Neighborhood Ass'n v. Episcopal Community, 148 Ariz. 1, 712 P.2d 914, 921 (Ariz. 1985) (Court acting in equity can "enjoin an unreasonable, albeit permitted activity as a public nuisance."); *Spur Industries, v. Del E. Webb Dev. Co.*, 494 P.2d 700, 705, 108 Ariz. at 183 (Ariz. 1975)

> (. . . despite the admittedly good feedlot management and good housekeeping practices by Spur, the resulting odor and flies produced an annoying if not unhealthy situation as far as the senior citizens of southern Sun City were concerned. There is no doubt that some of the citizens of Sun City were unable to enjoy the outdoor living . . .).

It is "highly probable" that Defendant's Tonopah facility will be both a private and a public nuisance based both in common law and on applicable state statutes. This Court should abate the nuisance and require Hickman to locate the Facility elsewhere.

1. The Facility will be a "Private Nuisance" and a "Public Nuisance"

A private nuisance derives from an "interference with a person's interest in the enjoyment of real property. A private nuisance is a 'nontrespassory invasion of another's interest in the private use and enjoyment of land.'. . ." *Armory Park Neighborhood Ass'n,* 712 P.2d at 917. "[T]o constitute a nuisance, the complained-of interference must be substantial, intentional and unreasonable under the circumstances." *Id.* at 920.

While a private nuisance affects an individual or a definite small number of persons in the enjoyment of private rights not common to the public, a public nuisance affects the rights enjoyed by citizens as a part of the public. That is, a public nuisance affects a considerable number of people or an entire community or neighborhood. *Spur Industries,* 494 P.2d at 705; *Armory Park Neighborhood Ass'n*, 712 P.2d at 917.

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It is well settled that a "nuisance may be simultaneously public and private when a considerable number of people suffer an interference with their use and enjoyment of land." *Armory Park Neighborhood Ass'n*, 712 P.2d at 917; *citing, Spur Industries*, 108 Ariz. at 184, 494 P.2d at 706. Thus,

> [w]hen the public nuisance substantially interferes with the use or enjoyment of the plaintiff's right in land . . . there is a particular kind of damage, for which the private action will lie. Not only is every plot of land traditionally unique in the eyes of the law, but in the ordinary case the class of landowners in the vicinity of the alleged nuisance will necessarily be a limited one with an interest obviously different from the of the general public. The interference itself is of course a private nuisance; but is none the less particular damage from a public one, and the action can be maintained upon either basis, or upon both.

Id., quoting, Prosser, *Private Action for Public Nuisance*, 52 Va.L.Rev. 997, 1018 (1966). The operation of the Facility will constitute both a private and public nuisance.

In addition to actionable common law notions of nuisance, A.R.S. § 36-601 provides, in pertinent part, that "[a]ny condition or place in populous areas that constitutes a breeding place for flies, rodents, mosquitoes and other insects that are capable of carrying and transmitting disease-causing organisms . . ." is a "public nuisance." *Id.* at (A)(1); *see also, e.g.*, A.R.S. § 36-601(A)(6) ("Any vehicle or container that is used in the transportation of . . organic material and that is defective and allows leakage or spillage. . ."); A.R.S. § 13-2917(A)(1) (It is a "public nuisance" to be "injurious to health. . . offensive to the senses or an obstruction to the free use of property that interferes with the comfortable enjoyment of

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life or property by an entire community or neighborhood or by a considerable number of persons."); A.R.S. § 49-141 (Environmental Nuisance).[5]

a. It Is Highly Probable That The Tonopah Facility will Emit Noxious Odors and Breed Flies and Mosquitos – an Inevitable Result of Housing Millions of Chickens in a Relatively Small Area

Plaintiffs contacted scientists from Johns Hopkins University, Bloomberg School of Public Health, who reviewed available documentation on the Facility. These scientists visited the Tonopah construction site. The team from Johns Hopkins also did environmental testing at Hickman's Maricopa and Arlington facilities and made various observations – all of which are set forth in their report, attached hereto as Ex. 1. According to the team from Johns Hopkins, "it is highly likely that the proposed Tonopah facility will . . . constitute a public nuisance and a potential health threat to members of the surrounding community." Ex. 1 at 2.

Odors are an inevitable result of housing millions of chickens in a relatively small area and of utilizing wastewater lagoons. When questions were raised at a public meeting about odors at the Facility, Billy Hickman responded:

> B. Hickman: So I'm not saying that we don't put off an odor. I'm not going to say that I'm going to satisfy everybody. But we bought this property because of the proximity to I-10.

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[5] Plaintiffs will also suffer property/business devaluation if the Facility is allowed to operate in its current location. Such devaluation, however, can often be remedied by money damages. If the instant action for "anticipatory nuisance" does not result in the closing/relocating of the Facility, Plaintiffs, and others, currently anticipate seeking abatement, or in the alternative, money damages, once a claim for traditional nuisance is ripe/available.

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. . .

> Audience Speaker: why would you put a stench factory in the middle of a residential neighborhood?
>
> . . .
>
> B. Hickman: Okay. So we are putting – we are putting an agricultural business on an agricultural-zoned property. That's the answer to your question.

Ex. 6 at 19-20 (Transcript of public meeting); *see also, e.g., id.* at 92 (B. Hickman: "You know, when you have any kind of animal agriculture, you are going to have an odor, okay.").

With regard to the Facility providing a breeding ground for flies (like their other facilities), Mr. Hickman admits, "[i]t's a concern for us. . ." Ex. 6 at 100.

According to the team of scientists from Johns Hopkins:

> The study authors concluded that large layer operations [2 million hens] may significantly increase house fly populations up to four miles from the facilities and may result in a 'severe nuisance' up to two miles away. Prior studies have also shown that flies from nearby animal confinement operations may be involved in the transmission of pathogens, including antibiotic resistant strains, to nearby communities. . .

Ex. 1 at 11-12.

As for mosquitoes, Mr. Hickman asserted that, "we are concerned about mosquitoes. . . . because that's how things are transmitted, is through mosquito bites, for both people and chickens. That's how they get pox and that kind of thing. So we have a pretty – pretty in-depth management, pest control management. In fact, we have a licensed pest control operator on our staff that is full-time." *Id.* at 99.

The wastewater lagoons create breeding grounds for insect vectors, including mosquitos. West Nile virus, carried by these mosquitos, is currently a major issue in Arizona,

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including Maricopa County. According to the CDC, Arizona already ranks in the top ten of states nationwide for total cases of West Nile virus, of neuroinvasive disease cases resulting from the virus, and of total deaths from the West Nile virus.

The Johns Hopkins Scientists concluded that:

> [W]e believe it is highly likely that the proposed Tonopah facility will . . . pose a potential health threat and constitute a "public nuisance" to nearby/downwind communities, as defined by Arizona Revised Statutes § 36-601, which provide the following criteria: "[a]ny condition or place in populous areas that constitutes a breeding place for flies, rodents, mosquitoes and other insects that are capable of carrying and transmitting disease-causing organisms . . ." Furthermore, A.R.S. § 13-2917(A)(1) states that is a "public nuisance to be "injurious to health . . . offensive to the senses or an obstruction to the free use of property that interferes with the comfortable enjoyment of life or property by an entire community or neighborhood or by a considerable number of persons."

Ex. 1 at 12.

Common sense and anecdotal evidence similarly support the proposition that it is "highly probable" that security and working lights running 24 hours, and noise from exhaust fans, trucks and operations in general will constitute both a public and private nuisance in their own right. Moreover, if, as proposed, massive amounts of manure are to be transported by truck, it is highly likely that some of it will spill onto the public roadways. *See*, A.R.S. § 36-601(A)(6) ("Any vehicle or container that is used in the transportation of . . . organic material and that is defective and allows leakage or spillage. . .").

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b. It is Highly Probable That Hickman's Ammonia Emissions Will Constitute a Public and Private Nuisance

It is well established that "[a]irborne contaminants that are generated in the raising of . . . poultry detrimentally affect . . . air quality in nearby areas. . ." Yeh-Chung Chien, et al., *Characteristics of Microbial Aerosols Released from Chicken and Swine Feces, Journal of the Air & Waste Management Assoc.*, Vol. 61 at 882 (2011). According to technical comments submitted to the U.S. EPA in 2006 by the Environmental Integrity Project:

> [t]he livestock sector produces an estimated 73% of all ammonia emissions nationwide. Poultry operations are widely recognized as the leading source of ammonia releases within the livestock sector with individual poultry operations producing staggering quantities of ammonia gas . . . Recent studies suggest that layer operations with more than 44,000 birds . . . may trigger the [CERCLA and EPCRA] reporting requirements (100 pounds per day of ammonia emissions) . . .
>
> Ammonia is a human toxin that EPA lists alongside arsenic, cyanide, and benzene as hazardous substances . . . Human exposure to ammonia triggers respiratory problems, causes nasal and eye irritation, and in extreme circumstances is fatal. Ammonia concentrations of greater than 100 ppm have been regularly reported in poultry confinement operations, with maximum concentrations reaching over 200 ppm. These concentrations exceed virtually every recognized safety threshold for ammonia exposure, ranging from the reference concentrations of 0.144 ppm established by the EPA for community exposure . . .
>
> Downwind neighbors are exposed to elevated ammonia levels, as well as other pollutants. . .

Id. (Ex. 9 at 3-4).

The Facility will vent ammonia (generated by millions of chickens) directly into the atmosphere by large ventilation fans. It is highly probably that ammonia emissions from the Facility will, in-and-of-themselves, be both a private and public nuisance.

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c. It is Highly Probable That Hickman's Truck Emissions and Impacts on Public Roadways Will Constitute a Public and Private Nuisance

Increased heavy truck traffic on relatively narrow country roads is another unreasonable and an inevitable consequence of Facility operations. "In determining whether to enjoin an anticipatory nuisance, a court may not ignore the inevitable consequences to follow upon the conduct of the business which the defendant proposes to carry on, however well conducted." *Hall v. North Montgomery Materials, LLC*, 39 So.3d 159, 177 (2008) (finding that anticipated truck traffic constituted an anticipatory nuisance.); *see also, e.g., City of Greenwood v. Martin Marietta Materials, Inc.*, 299 S.W.3d 606 (2009) (increased truck traffic is a nuisance). Here the inevitable truck traffic will create a fundamental alteration in the quantity and quality of the traffic. *See, e.g., Hall*, 39 So.3d at 177 *quoting, State ex rel. Brookside poultry Farms, Inc., v. Jefferson*, 125 Wis.2d 387, 455 (1985)

> ([the] board heard extensive testimony on the truck and equipment traffic that would be generated by a 240,000 hen operation . . . and concluded that such traffic could create a health and safety hazard in the area. . . . the same may be said for the findings and conclusions relating to odor nuisance and waste disposal problems. . .)

Mikhail Chester, Ph.D. from Arizona State University analyzed the emissions of anticipated truck traffic generated by Tonopah facility operations. *See, Analysis of Air Emission from the Hickman Farms Egg Facility in Tonopah Arizona.* attached at Ex. 7. According to Professor Chester:

> [E]ven at the lowest production level (2.2 million chickens in Scenario 1) the study site experiences 82% increases in PM emissions and a 48% increase in NOx emissions. In Scenario 2 (a reasonable ramp up to 8 million chickens),

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> the study site experiences a 286% more PM emissions, near 167% more NOx emissions and 84% and 69% increases SO2 and NMHC emissions . . .
>
> [T]he analysis does not consider emissions from vehicle idling at the Egg Facility. It also does not consider the background pollutant concentrations in the region and how increases in these pollutants from Egg Facility traffic may lead to increased exposure by the nearby population and the associated public health impacts. Furthermore, emissions from the facility itself such as those from activities or onsite equipment (e.g. generators or machinery) are not considered.

Ex. 7 at 8. Such emissions are linked to a variety of short and long-term respiratory, cardiovascular, and other ailments impacting individual and public health.

B. Shane Underwood, Ph.D., also from Arizona State University, reviewed the anticipated Hickman truck traffic vis-à-vis impacts on the public roads. Professor Underwood concluded, *inter alia*, that the existing infrastructure was not designed to accommodate the type of truck traffic that the Facility will generate. According to Professor Underwood, "it is highly likely that the proposed facility will negatively impact Indian School Road. . ." *Ex 8.* at § 6.

Specifically according to Professor Underwood, failure to upgrade the existing County roads will likely:

> result in the development of pavement ruts (longitudinal depressions along the travel direction or fatigue cracks (irregularly shaped cracking pattern starting in the wheel paths and eventually extending over the whole pavement surface. . . : fatigue cracks can increase the overall pavement roughness and in extreme cases reduce the speed with which vehicles can manageably travel. They may also permit water to enter the pavement system degrading the pavement support further and also causing potholes. If rutting does develop it is most likely to occur nearest the intersection of Indian School Road and 411th avenue . . .

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Id; c.f. Hall, 39 So.3d at 177 (Court found anticipatory nuisance when evidence showed that truck traffic will damage the roads "because the heavy-truck traffic is an inevitable consequence of the . . . company's business."); *Coyote Flats*, 596 N.W.2d at 352 (Same).

Dust, fumes and noise from CAFO truck traffic will unreasonably interfere with the Plaintiffs' and community's use and enjoyment of their land, homes, and businesses. The streets will deteriorate from the constant heavy weight. Aspects of this deterioration will create more safety issues for the traveling public. *See, Hall,* 39 So.3d at 176 ("a business [that] routinely places oversized vehicles on a narrow road that impedes passing traffic and unduly increases the risk of accidents . . .should be considered a nuisance. . . continuous use of a public road in such a manner as to deprive the traveling public of their full and intended use of the road amounts to a nuisance."). Children will not be able to ride their bikes or even safely stand at a school bus stop.

2. Plaintiffs Can Demonstrate the Possibility of Irreparable Injury in the Absence of an Injunction

Plaintiffs' can demonstrate the possibility of irreparable injury in the absence of an injunction. The Facility will produce foul odors, ammonia and other harmful emissions, and flies/mosquitoes. Moreover, the Facility is located adjacent to tributaries to jurisdictional washes and in the footprint of a floodplain. i.e., it is also highly probable that the Facility will impact ground and surface waters.[6] There is no adequate remedy at law for these types

[6] Volatized ammonia from poultry operations affects local water bodies, as well as water bodies that are hundreds of miles from the site of origin. Ex. 9 at 5; *see, also, e.g., National Pork Producers v. U.S. EPA*, 635 F.3d 738, 756 (5th Cir. 2011) (Upholding EPA Guidance

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of injuries. Barring some extremely unusual circumstance (which is not present in the instant case), an injunction should be issued. *E.g., Idaho Sporting Congress,* 222 F.3d at 569; *Amoco Production Co. v. Village of Gambell*, 480 U.S. 531, 545, 107 S. Ct. 1369 (1987) ("environmental injury, by its nature, can seldom be adequately remedied by money damages and is often permanent or at least of long duration, i.e., irreparable").

The inevitable truck traffic will injure people's health, negatively impact the safety of neighbors and travelers, damage roadways and interfere with the use and enjoyment of Plaintiffs' and the community's property and business operations. Again, the only way to abate these harms is through injunctive relief. i.e., money damages in the absence of an injunction cannot make Plaintiffs whole.

It is also highly probable that the Facility will destroy/irreparably harm neighboring small businesses. *See, Salt River Project Ag. v. Sun M.P. LLC*, 2007 WL 5434008, ¶ 27 (Ariz. App. 2007), *citing, Bailey v. Myers*, 206 Ariz. 224, 226 ¶ 8, 76 P.3d 898, 900 (App. 2003) (Possible destruction of family business is irreparable harm); *Am. Passage Media Corp v. Cass Comm'ns, Inc.*, 750 F.2d 1470, 1474, (9th Cir. 1985) (The threat of being driven out of business is irreparable harm).

For example, Plaintiff Julie Park owns "El Dorado Hot Springs." El Dorado Hot Springs is located in a Known Geothermal Resource Area, less than 3,000 feet from the

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Letters requiring poultry growers to apply for permits for discharge to jurisdictional waters resulting from the release of dust, dander, and feathers through poultry confinement house ventilation fans).

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Facility. It caters to guests from all over the world who come to soak in the hot mineral water. If the Facility is built, according to Ms. Park:

> I will have to abandon my business and walk away. If a giant egg factory is located less than 3,000 feet of here. I will have no more customers to rent my cabins to soak in the healing waters. The view of the mountains from the three most popular soaking tubs will be completely ruined and replaced by 30 to 40 foot high chicken houses with even higher vent stacks spewing the stench, dander, feathers and manure. Even if they could stand the smell and noise, people who come here to soak and star-gaze at night will no longer patronize my hot springs because the night sky will be ruined by hundreds of security lights. There will also be a steady stream of semi-trailer trucks to and from the egg factory that will further shatter the tranquility and silence we now enjoy – a fundamental part of my business.

See, e.g., Complaint Ex. 2 (Affidavit of Julie Park).[7]

Plaintiffs Camilla Van Sickle and William Pennington live approximately one-half mile east of the Facility. They own/operate a small hot spring soaking, camping, and rental/cottage retreat business named "Casa Blanca Hot Spring" from their home. If the Facility is allowed to operate, the smell, noise, lights, traffic, etc. will destroy their family business. *See*, Complaint Exs. 8 and 9 (Affidavits of Camilla Van Sickle and William Pennington).

Plaintiff, David Dyrcz, lives less than a mile from the Facility. His home is on 5.25 acres that also includes his family business known as Saguaro Hot Mineral Wells Motel. The motel has 15 units. People enjoy bathing in the open air under pristine desert skies. Mr. Dyrcz's business depends on appealing to customers concerned for the purity of the

[7] The Plaintiffs' Affidavits are included as Exhibits to the Complaint in the instant matter. They are not reattached hereto, but rather incorporated herein, in their entirety, by this reference.

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surrounding environment. If the Facility is allowed to operate, it is highly probable that it will destroy Mr. Dyrcz's family business. *See*, Complaint Ex. 10 (Affidavit of David Dyrcz).

Plaintiffs Oscar Lopez and Diocelina Lopez own and operate the "Tonopah Family Restaurant y Cantina" at 41101 W. Indian School Road in Tonopah – about one mile east of the Facility. If the Facility goes into operation the stink, flies and other vermin from the Facility will destroy their family business. It is impossible to run a restaurant less than a mile from a Facility that will house millions of chickens in a relatively confined area. It is highly probable that the Facility will destroy the Lopez's family business. *See,* Complaint Exs. 12 and 13 (Affidavits of Oscar Lopez and Diocelina Lopez).

Plaintiff, Song Mun, owns and leases real property to five separate businesses, known collectively as "Tonopah Joe's," within one-half mile of the Facility. The five businesses operating as Tonopah Joes include a: (1) towing service; (2) tire shop; (3) recycling center; (4) restaurant; and (5) trailer park. Mr. Mun's tenants have already indicated that they will not renew their leases if the Facility moves in. *See*, Complaint Ex. 5 (Affidavit of Song Mun).

Plaintiffs have demonstrated a strong likelihood of success on the merits and the possibility of irreparable injury in the absence of an injunction. This Court should abate the anticipatory nuisance and grant Plaintiffs the requested injunction.

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3. In the Alternative, Plaintiffs Have Raised Serious Legal Questions and the Balance of Hardships Tips Sharply in Plaintiffs' Favor

As indicated *supra*, courts apply the preliminary injunction standard on a "sliding scale." That is, the moving party may establish either: (1) probable success on the merits and the possibility of irreparable injury; or (2) the presence of serious questions and that the balance of hardships tips sharply in favor of the moving party. In determining whether "serious questions" exist to support a preliminary injunction, the relevant inquiry is whether there are "serious questions going to the merits." *Arizona Association of Providers for persons with Disabilities v. State*, 223 Ariz. 6, 219 P.3d 216, ¶¶ 12-13 (App. 2009), *citing Shoen v. Shoen*, 167 Ariz. 58, 63, 804 P.2d 787, 792 (App. 1990).

Plaintiffs demonstrated "probable success on the merits and the possibility of irreparable injury." *Id.* (*see* discussion *supra*). They also, however, can demonstrate "the presence of serious questions and that the balance of hardships tips sharply in [their] favor." *Id.*

Defendants will suffer no irreparable harm if an injunction is issued. *See, e.g., Northern Alaska Envtl Ctr. V. Hodel*, 803 F.2d 466, 471 (9th Cir. 1986) ("more than pecuniary harm must be demonstrated" in order to avoid an injunction). Plaintiffs on the other hand, have raised the prospect of irreparable harm to public and personal health, business, public rights-of-way, the environment and safety. In these types of cases, it is generally accepted that, "if such injury is sufficiently likely . . . the balance of harms will usually favor the issuance of an injunction to protect the environment." *Id.* at 1299, *quoting*

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Amoco production Co., 480 U.S. at 545. For these same reasons, the question of "relative hardship to the parties" (the "critical element" in the analysis) also weighs heavily in favor of granting the requested injunction. The public interest also tips strongly in favor of granting an injunction. *See, e.g., Oregon Natural Resources Council Fund v. Goodman*, 505 F.3d 884, 898 (9th Cir. 2007), *quoting, Lands Council v. McNair*, 494 F.3d 771, 780 (9th Cir. 2007) ("this Court has 'held time and again that the public interest in preserving nature and avoiding irreparable injury outweighs economic concerns.'"); *see, also, e.g., Sierra Nev. Forest Prot. Campaign v. Tippin,* No. 06-00351, 2006 WL 2583036, at *21 (E.D.Cal. Sept. 6, 2006) ("The environment is a vital constituent public interest that must be recognized and protected . . . even in the face of adverse economic consequences."); *see also, Monsanto v. Geertson*, 2010 WL 2471057, *11 (S.Ct June 21, 2010) (Plaintiff must show only that "the public interest would not be disserved by a permanent injunction.").

B. Conclusion

In the instant case: (1) the balance of hardships tips sharply in plaintiffs' favor; (2) plaintiffs will suffer irreparable injury if an injunction is not granted; (3) defendants will not suffer any irreparable harm; (4) plaintiffs have demonstrated a probability of success on the merits; and (5) plaintiffs have raised serious legal questions. Money damages in the absence of an injunction cannot prevent or undo the harm the Facility will cause to Plaintiffs and/or make Plaintiffs whole. Plaintiffs respectfully request that their motion for injunctive relief be granted so the *status quo* can be maintained pending the outcome of this litigation.[8]

[8] The Court should not require the posting of a bond. Plaintiffs, who are acting in the public interest, do not have the economic resources to afford a substantial bond. If a bond is

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Respectfully Submitted This 5th Day of August, 2014.

THE SHANKER LAW FIRM, PLC.

By _____

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required it should be nominal. *Davis v. Mineta*, 302 F.3d 1104, 1126 (10th Cir. 2004), *citing, Friends of the Earth, Inc. v. Brinegar*, 518 F.2d 322, 322-323 (9th Cir. 1975); *see also, e.g., Wisconsin Heritages, Inc. v. Harris*, 476 F. Supp. 300, 303 (E.D. Wisc. 1979) (no bond); *Scherr v. Volpe*, 466 F.2d 1027 (7th Cir. 1972) (no bond); *Natural Resources Defense Council, Inc. v. Morton*, 337 F. Supp. 167 (D.D.C. 1971) ($100); *Environmental Defense Fund v. Corps of Engineers*, 331 F. Supp. 925 (D.D.C. 1971) ($1.00).

ORIGINAL filed with the Clerk,
Maricopa County Superior Court,
and one copy delivered to assigned
Judge this 5th day of August, 2014;

COPY delivered via hand-delivery
this 5th day of August, 2014 to:

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INDEX OF EXHIBITS TO
PLAINTIFFS' MOTION FOR TEMPORARY RESTRIANING ORDER (WITH NOTICE) OR, IN THE ALTERNATIVE PRELIMINARY INJUNCTION

August 5, 2014

Exhibit	Description
1	Report of Scientists from Johns Hopkins, Bloomberg School of Public Health
2	A Report of the Pew Commission on Industrial Farm Animal Production, *Putting Meat on the Table: Industrial Farm Animal Production in America* (April 29, 2008)
3	David Madrid, *Hickman's egg factory planned for Tonopah hatches riff*, Arizona Republic (February 10, 2014)
4	Establishment Inspection Report (May 5, 2011)
5	Site Plan
6	Transcript of public meeting on January 9, 2014
7	*Analysis of Air Emission from the Hickman Farms Egg Facility in Tonopah Arizona by* Mikhail Chester, Ph.D. (June 4, 2014)
8	Pavement Impacts from Proposed Hickman Farms Egg Facility in Tonopah, Arizona by B. Shane Underwood, Ph.D.
9	U.S. EPA in 2006 by the Environmental Integrity Project - Poultry Petition for exemption from EPCRA and CERCLA Reporting Requirement for Ammonia Emissions (March 27, 2006)

EXHIBIT 1

Report of Scientists from Johns Hopkins-
Bloomberg School of Public Health

Johns Hopkins Bloomberg School of Public Health
615 North Wolfe Street, W7010
Baltimore, MD 21205

July 09, 2014

The Shanker Law Firm, PLC
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Tempe, Arizona 85283

Disclaimer: The opinions expressed herein are those of the authors and do not necessarily reflect the views of The Johns Hopkins University.

Re: Hickman's Family Farms, Inc. / Saddle Mountain RV Park

We are writing to present our concerns regarding the construction of a layer facility in Tonopah, Az., owned and operated by Hickman's Family Farms, Inc. We are researchers at the department of Environmental Health Sciences at the Johns Hopkins Bloomberg School of Public Health. Our collective expertise is in air quality, animal agriculture, environmental health sciences and public health.

To characterize the potential effects of the Tonopah facility on the surrounding community, we investigated two similar layer facilities located in Arlington, Az. and Maricopa, Az. We collected data on particulate matter, ammonia, odors, and fly populations from six sample sites at and around the Arlington facility, and four sample sites at and around the Maricopa facility.

Key findings from our investigation include:

Particulate Matter (PM): At both facilities, peak airborne PM concentrations were highest at the facility fence lines and declined with increasing downwind distance, and were lowest at sites that were outside the wind's trajectory through the facilities. At Maricopa, median PM concentrations were highest at the facility fence line. At Arlington, median PM concentrations were highest at the two downwind sample sites closest to the facility. At both facilities, median PM concentrations were lowest at sites that were outside the wind's trajectory through the facilities.

Ammonia: At both facilities, ammonia concentrations were highest at the facility fence lines, declined with increasing downwind distance, and were lowest at sites that were outside the wind's trajectory through the facilities. For seven of the ten sample sites, levels were below the method's limit of detection. At Arlington, ammonia concentrations at the facility fence line exceeded the EPA

chronic reference concentration (RfC) for adverse respiratory health effects associated with chronic inhalation (1).

Odors: At both facilities, odor levels were highest at the facility fence lines, declined with increasing downwind distance, and were lowest at sites that were outside the wind's trajectory through the facilities.

Flies: At both facilities, fly collection rates were highest at the facility fence lines. At Arlington, with the exception of one sample site (the exception may have been the result of interference from a nearby waste disposal site), fly collection rates declined with increasing distance from the facility. Prior research suggests large layer operations may significantly increase house fly (*Musca domestica*) populations up to four miles from facilities and may result in a "severe nuisance" up to two miles away (2).

Taken together, these findings strongly suggest the Arlington and Maricopa facilities contribute to elevated PM and ammonia concentrations, odors, and fly populations in nearby communities. Furthermore, based on these findings, we believe it is highly likely that the proposed Tonopah facility will similarly constitute a public nuisance and a potential health threat to members of the surrounding community.

Further details about our investigation are presented below. We also have concerns about the contribution of the facility to freshwater depletion; these are discussed in the Appendix.

Background

We understand that the first phase of the layer facility at Tonopah, Az. will accommodate 2.2 million layer hens (hereafter referred to as "layers"), with two open-lined pits for storing wastewater, including fluids used to clean and disinfect surfaces of eggs ("egg wash water") and effluent from washing housing interiors. From the materials that were accessible to us, the plan to handle manure is unclear, but we understand that fresh manure will drop onto a manure belt below enriched colony cages, to be conveyed at regular intervals to an area where it will be dried and trucked off site. We further understand that, at full capacity, Hickman's Family Farms, Inc. intends to have an inventory of up to 12 million chickens at the proposed facility. At the time of this writing, construction of the facility is underway.

The Tonopah facility is sited close to residences, natural attractions, and businesses. From the facility fence line, a recreation hot springs is located at 0.29 miles east, a restaurant is located 0.45 miles east, and an RV park is located 0.51 miles east. According to local business owners in

Tonopah, over 200 families reside at the RV park, and an estimated four to eight thousand individuals visit the hot springs annually.

The purpose of our investigation was to characterize the potential conditions near to and downwind from the Tonopah facility once in operation. To this end, we collected data on airborne particulate matter (PM), ammonia, odors, and fly populations from two similar facilities located at Arlington, Az. and Maricopa Az., both owned and operated by Hickman's Family Farms, Inc.

It is our understanding that the Arlington facility currently operates with an inventory of approximately 6 million layers, with an open-lined pit for storing wastewater (egg wash water and effluent from washing housing interiors). Manure from the facility is dried and composted on site. It is also our understanding that the Maricopa facility operates with an inventory of approximately 2.2 million layers, with an open-lined pit for storing wastewater. Manure from the facility is dried and trucked off site.

Study methods

On May 14 and 15, 2014, we collected air quality and other health-relevant (particulate matter, ammonia, odors and fly populations), and pertinent weather conditions (wind direction and speed) at selected sites near the Arlington and Maricopa facilities. The locations of sampling sites, relative to the property lines around each facility, are shown in Figures 1 and 2. All sampling occurred on public property, with the exception of one site NE of the Arlington facility, where we collected samples after securing permission from the property owner.

Wind conditions

Wind speed and wind direction data, prior to and during sampling periods, were collected from local weather sampling stations (3).

Particulate matter (PM)

PM was measured using light-scattering nephelometric monitors (pDR-1000, Thermo Scientific), with optimal response to particles in a size distribution between 0.1 and 10 micrometers in diameter. All monitors were zeroed before use in the field following manufacturer's instructions. At each sample site, two monitors were positioned approximately five feet above the ground and set to record PM concentrations every 30 seconds for a period of 29 to 107 minutes. At all monitoring locations, we recorded when vehicles passed by the monitors and removed the associated data from the final results in order to better isolate the effects of the layer facilities on air quality.

Ammonia (NH_3)

Ammonia was measured using 0.1 - 10 ppm-hrs Gastec Detector Tubes. At each sample site, two tubes were activated for a period ranging from approximately 45 minutes to 14 hours, and periodically observed for changes in concentration levels. Final readings were converted from part per million-hours (ppm-hours) to ppm (one part ammonia in one million parts of air) based on how long they were sampling in the field.

Odors

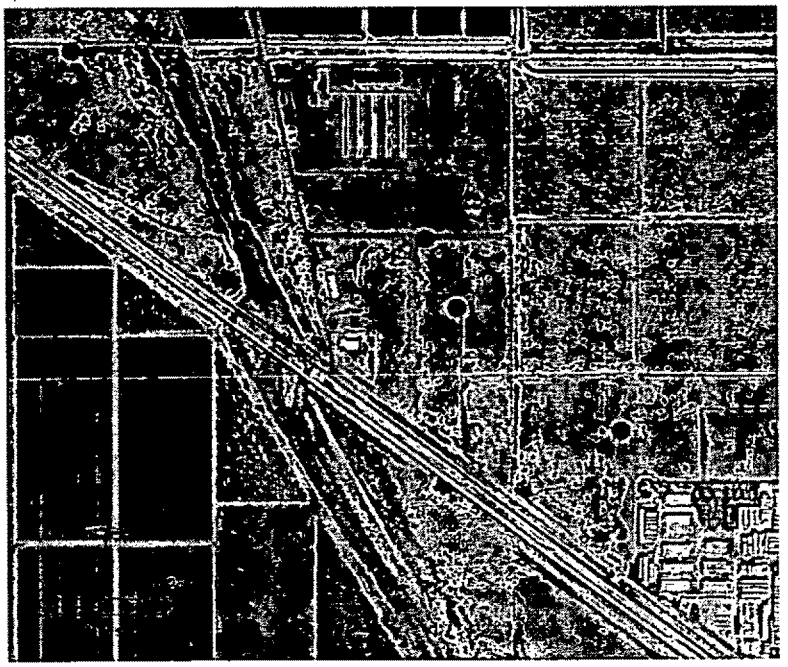
Odors at each site were independently assessed and recorded by each member of our research team, using a subjective scale ranging from 0 (no detectable odor) to 10 (very strong odor). In order to mitigate the effects of odor desensitization, odor measurements were first recorded at farthest sites outside the wind's trajectory through each facility, followed by the sites furthest downwind, and finally at sites closest to the facilities.

Flies

Fly populations were estimated using Rescue brand re-usable baited jug traps. At each sample site, a jug trap was filled with a bait mixture and left for a period ranging from approximately 1.5 to 15.5 hours. Jug traps were positioned downwind from other air sampling equipment in the unlikely event that the bait mixture might interfere with readings. At the end of each sampling period, captured flies were removed from the trap and counted. Insects that did not clearly exhibit distinguishing features of *Musca domestica* (e.g., red compound eyes, single pair of wings, gray thorax with longitudinal stripes, short antennae, etc.), *Sarcophagidae* (flesh fly), or *Calliphoridae* (carrion fly) were excluded from final counts. Because these flies are largely diurnal and inactive at night, final fly counts were expressed as collected flies per daylight hour.

Figure 1. Sample sites around the Arlington facility.

Figure 2. Sample sites around the Maricopa facility.



Results

Wind conditions

Wind conditions on both sampling days were highly variable, both in terms of speed and direction.

At Arlington, wind speeds during the sampling period on May 14th, 2014 were between 0 and 14 mph, with gusts up to 18 mph. Winds one hour prior to and during the sampling period were predominantly from the SE, at times varying between ESE and SSE. Average wind speeds for the month of May (and Anecdotal reports from local residents) suggest our investigation of the Arlington facility took place during a period of uncharacteristically high wind speeds (3).

At Maricopa, wind speeds during the sampling period on May 15th, 2014 were between 0 and 7 mph. Winds over the 14 hours prior to sampling were predominantly from the NE, and varied between SE, E, NNE, and WNW during the sampling period (3).

Particulate matter (PM)

At Maricopa, median PM concentrations were highest at the facility fence line (22 $\mu g/m^3$), and roughly twice as high as concentrations recorded farther downwind and outside the wind's trajectory through the facility (9-13 $\mu g/m^3$). At Arlington, median PM concentrations within 0.31 miles downwind of the facility (21-32 $\mu g/m^3$) were 130 to 300 percent higher than sites farther downwind and not downwind (8-9 $\mu g/m^3$). At both facilities, median PM concentrations were lowest at sites that were outside the wind's trajectory through the facilities.

At both facilities, peak PM concentrations were highest at the facility fence lines, declined with increasing downwind distance, and were lowest at sites that were outside the wind's trajectory through the facilities. The highest peak concentration at Arlington (432 $\mu g/m^3$) was over ten times higher than the peak concentration recorded 1.35 miles downwind (38 $\mu g/m^3$).

Median and maximum PM concentrations associated with the Arlington and Maricopa facilities are shown in Table 1. Median PM concentrations and associated interquartile ranges for each site are shown in Figures 3 and 4. PM values logged by each instrument were within ±10% agreement.

Ammonia (NH_3)

At both facilities, ammonia concentrations (Table 1) were highest at the facility fence lines, declined with increasing downwind distance, and were lowest at sites that were outside the wind's trajectory through the facilities. For seven of the ten sample sites, levels were below the limit of detection (LOD) for the method used.

Odors

At both facilities, odor levels (Table 1) were highest at the facility fence lines, declined with increasing downwind distance, and were lowest at sites that were outside the wind's trajectory through the facilities.

Table 1: Air quality and odors associated with Arlington and Maricopa facilities.

Facility	Site[a]	PM (µg/m^3)			NH_3 (ppm)	Odor
		Median[b]	IQR[b,c]	Max[b]		
Arlington	Fence line	21	14	432	0.55	8.50
	0.31 mi W (downwind)	32	24	108	0.12	5.00
	1.35 mi NW (downwind)	9	5	38	<LOD[d]	0.67
	0.28 mi SW*	8	3	11	<LOD	1.33
	1.35 mi SW*	8	3	25	<LOD	0.00
	1.30 mi NE*	9	6	36	<LOD	1.33
Maricopa	Fence line	22	75	239	0.10	8.83
	0.14 mi S (downwind)	12	9	135	<LOD	6.25[e]
	0.43 mi SE*	13	4	62	<LOD	2.83
	0.37 mi W*	9	5	91	<LOD	0.00

*Site outside the wind's trajectory through the facilities.

[a]*Relative to property lines.*

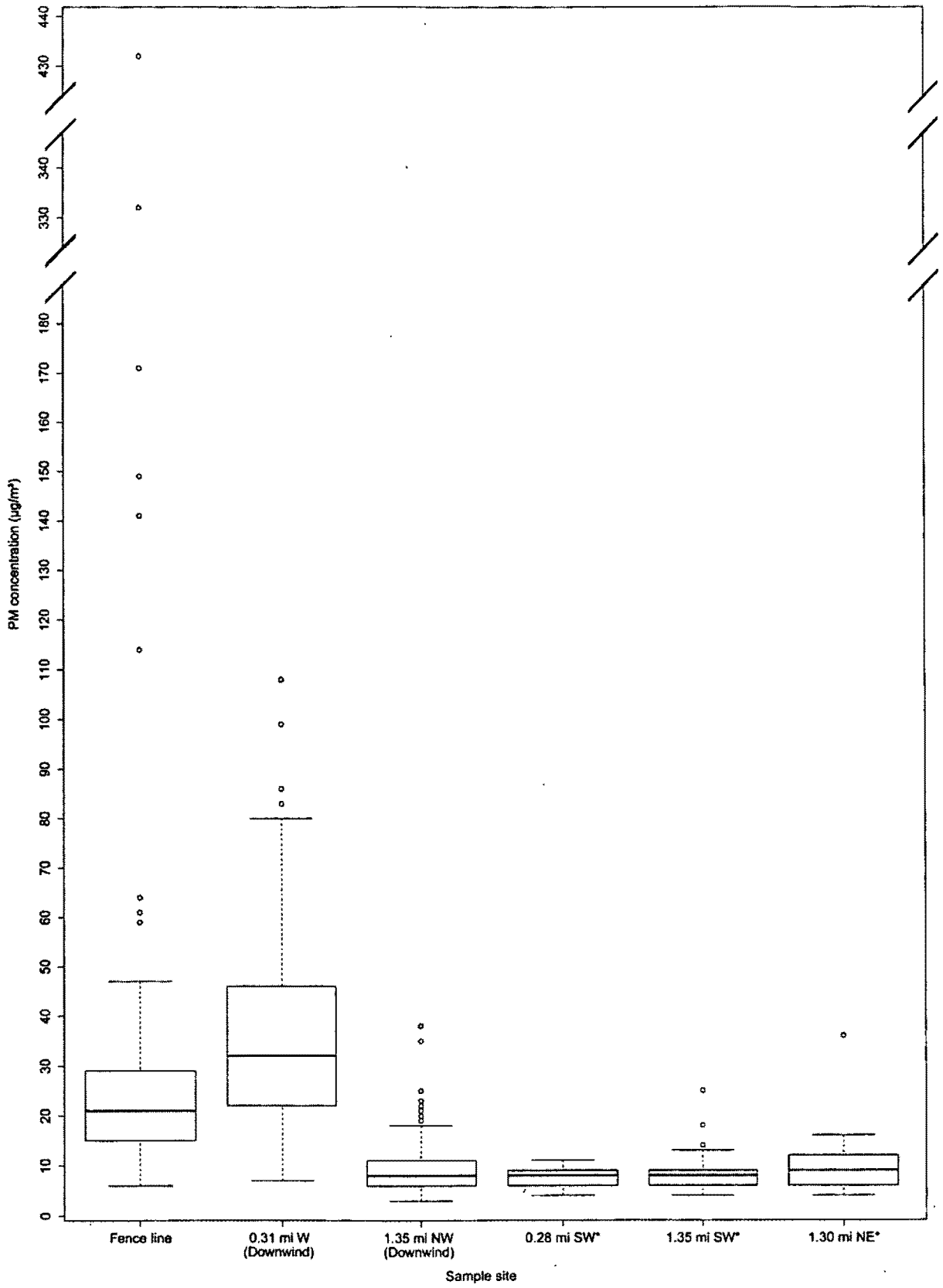
[b]Based on pooled readings from both monitors.

[c]Interquartile range.

[d]Below the limit of detection for the sampling method.

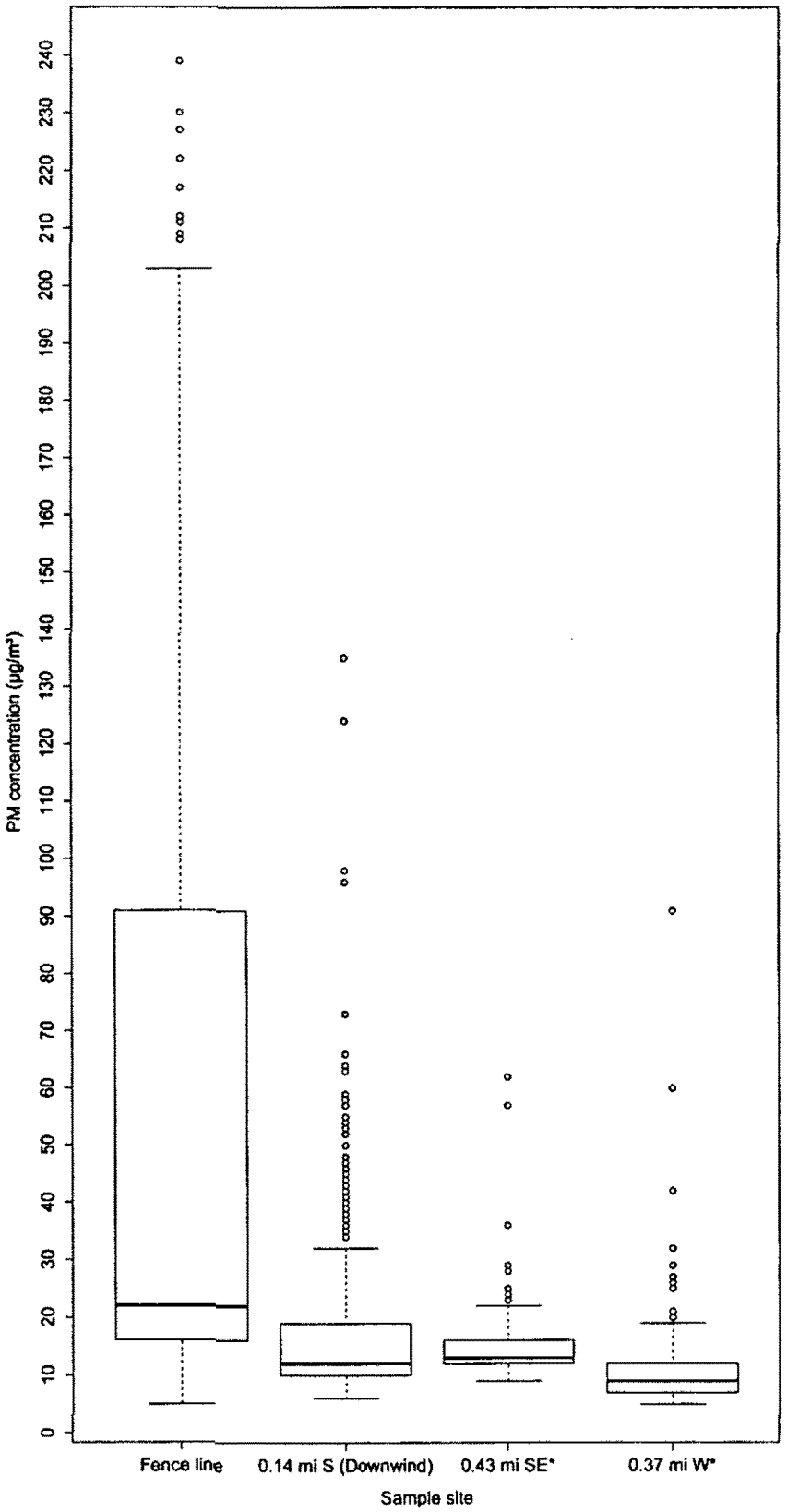
[e]One researcher was not present this site, thus this is the average of two data points instead of three.

Figure 3: Median PM concentrations and interquartile ranges at Arlington sample sites.



*Site outside the wind's trajectory through the facilities.

Figure 4: Median PM concentrations and interquartile ranges at Maricopa sample sites.



*Site outside the wind's trajectory through the facilities.

Flies

At both facilities, fly collection rates (Table 2) were highest at the facility fence lines. At Arlington, with the exception of one sample site (NE of the facility), fly collection rates declined with increasing distance from the facility, irrespective of wind direction. A photo of a jug trap following the collection period is shown in Figure 5.

Figure 5: Fly trap after collection period.

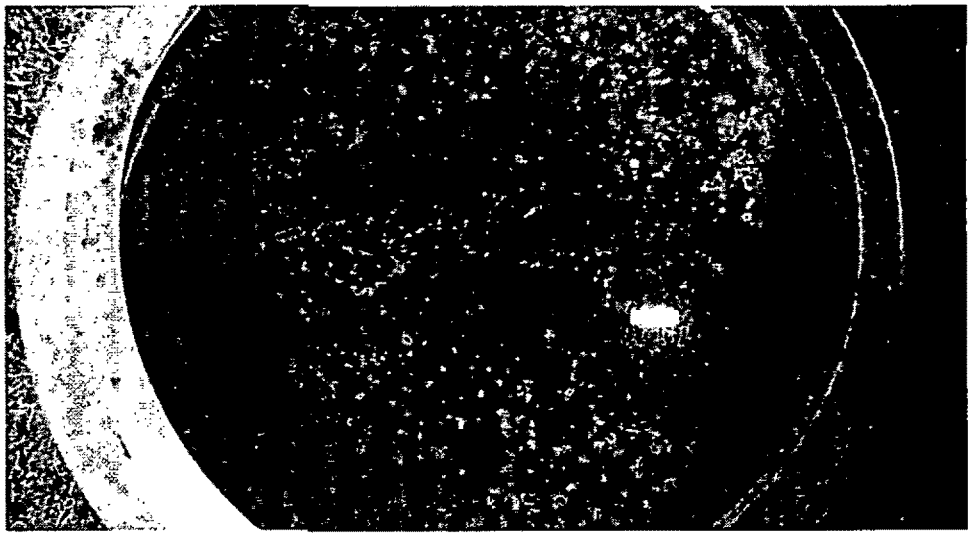


Table 2: Flies collected, per daylight hour, near the Arlington and Maricopa facilities.

Facility	Distance from property line	Flies per daylight hour
Arlington	0.00 mi (W)	1.95
	0.28 mi (SW)	1.08
	0.31 mi (W)	1.04
	1.30 mi (NE)	1.45
	1.35 mi (SW)	0.67
	1.35 mi (NW)	0.43
Maricopa	0.00 mi (S)	0.30
	0.14 mi (S)	0.00
	0.37 mi (W)	0.00
	0.43 mi (SE)	0.00

Discussion

The degree to which levels of airborne pollutants increase with greater downwind proximity to a layer facility is highly suggestive of that facility's contributions to downwind pollutants. If a facility is a source of airborne pollutants, for example, we would expect recorded concentrations of those pollutants to be highest at the facility fence line. Furthermore, if a facility attracts and/or serves as a breeding ground for flies, we would expect higher fly populations with increasing proximity to the facility, irrespective of wind direction. With a small number of exceptions, data collected as part of this investigation are consistent with these patterns, strongly suggesting that the Arlington and Maricopa facilities are contributors to elevated PM and ammonia concentrations, odors, and fly populations.

The instruments used in this investigation to measure particulate matter have an optimal response to particles between 0.1 and 10 micrometers in diameter. Assuming roughly half of the PM detected is PM 2.5 (a conservative estimate), median concentrations recorded 0.31 miles downwind of the Arlington facility (16 $\mu g/m^3$) exceeded U.S. Environmental Protection Agency (EPA) National Ambient Air Quality Standards (NAAQS) of 12 $\mu g/m^3$ (4).

Ammonia concentrations recorded at the Arlington facility fence line (0.55 ppm) exceeded the EPA's reference concentration (RfC) for adverse health effects associated with chronic inhalation (0.144 ppm) (1). The RfC can be interpreted as an airborne concentration of a contaminant below which adverse effects are unlikely to occur for persons chronically exposed. Above the RfC, adverse effects may occur. Ammonia concentrations recorded within 0.31 miles downwind of the Arlington facility and at the Maricopa facility fence line were 14 and 27 percent higher than the RfC, respectively.

Evidence from prior studies is consistent with our finding that the Maricopa and Arlington facilities are likely contributors to elevated fly populations. A four-year study published in 2005, for example, found strong associations between proximity to a Ohio layer facility (with an inventory of >2 million hens) and higher fly collection rates. Two years into the study period, a second layer facility was constructed. After the second facility was operational, fly collection rates increased significantly. The study authors concluded that large layer operations may significantly increase house fly populations up to four miles from the facilities and may result in a "severe nuisance" up to two miles away (2). Prior studies have also shown that flies from nearby animal confinement operations may be involved in the transmission of pathogens, including antibiotic resistant strains, to nearby communities (5,6). Persons near the Tonopah facility, such as those residing at the RV

park, may be at a heightened risk of exposure to vector-borne pathogens if, for example, they come into contact with surfaces that have been contaminated by flies.

Limitations

The results of this investigation may have been influenced by highly variable wind conditions, both in terms of speed and direction. Intermittent gusts of wind, for example, may partly explain the number of outliers in PM data for some sample sites. Results may also have been affected by interference from other potential sources of pollutants and/or flies. A waste disposal site, for example, was located NE of the Arlington facility, which may partly explain elevated odor levels and fly collection rates recorded NE of the facility.

The duration of the data collection period was very brief (two days). Because most dosimeter tubes were left operational for less than an hour due to time restrictions, reported ammonia concentrations—which were below the limit of detection for seven of ten sample sites—may under-represent actual concentrations. Similarly, fly jug traps were in operation for brief periods, particularly at Maricopa where traps were in operation for 1.5 to 3.5 hours, which may partly explain low collection rates.

Conclusion

Taken together, these findings strongly suggest the Arlington and Maricopa facilities contribute to elevated PM and ammonia concentrations, odors, and fly populations in nearby communities. Furthermore, based on these findings, we believe it is highly likely that the proposed Tonopah facility will similarly pose a potential health threat and constitute a "public nuisance" to nearby/downwind communities, as defined by Arizona Revised Statues § 36-601, which provide the following criteria: "[a]ny condition or place in populous areas that constitutes a breeding place for flies, rodents, mosquitoes and other insects that are capable of carrying and transmitting disease-causing organisms . . ." Furthermore, A.R.S. § 13-2917(A)(1) states that it is a "public nuisance" to be "injurious to health. . . offensive to the senses or an obstruction to the free use of property that interferes with the comfortable enjoyment of life or property by an entire community or neighborhood or by a considerable number of persons."

Sincerely,

Robert S. Lawrence, MD, MACP, FACPM
The Center for a Livable Future Professor in Environmental Health Sciences
Professor, Departments of Environmental Health Sciences, Health Policy and Management, and International Health, Johns Hopkins Bloomberg School of Public Health
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Kathryn M. Rees
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Appendix

In addition to the aforementioned concerns, the Tonopah facility poses a substantial water usage burden in area of water scarcity. The Tonopah facility is sited in the Phoenix Active Management Area (AMA) region, directly adjacent to the Harquahala Basin—an irrigation non-expansion area—and is located in the Tonopah Desert where there is an ongoing groundwater recharge project critical for water quality and water security in the region. The Tonopah site is approximately 10 miles from the Tonopah Desert Recharge Project (TDRP) which is regulated by the Arizona Department of Water and drainage patterns from the Tonopah area trend to the TDRP basin. In this area with water scarcity issues the AMA has two categories of wells: exempt wells, which pump less than or equal to 35 gallons per minute; and non-exempt wells, which pump greater than 35 gallons per minute. Based on the sources and calculations given in Table 3, the Tonopah facility, once in operation, would require the total use of an estimated 222 gallons per minute (for an inventory of 2 million layers) to 1,333 gallons per minute (for an inventory of 12 million layers) for drinking and egg wash water. *These estimates do not account for water use associated with irrigating feed crops.* Water withdrawals of this extent may affect yields in surrounding wells and limit water availability to other businesses and residences that rely on well water for drinking.

Table 3. Estimates of Water Usage for Layer Operations

# of layers	Egg wash water gallons/day[a]	Drinking water gallons/day[b]	Total water gallons/day
2,000,000	23,100	320,000	343,100
4,000,000	46,200	640,000	686,200
6,000,000	69,300	960,000	1,029,300
12,000,000	138,600	1,920,000	2,058,600

a. 0.0132 gallons/water/bird/day. Shappell NW. Egg Wash Wastewater: Estrogenic Risk or Environmental Asset? Integr Environ Assess Manag. 2013; 9(3):517-23.

b. 0.16 gallons/water/bird/day. Cooperative Research Farms. The Care and Feeding of a Successful Layer Operation. 2009. Available from: www.cccfeeds.com/assets/files/Resources/Poultry/Layer_Low_Res_%20RGB_Sept_2009.pdf

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EXHIBIT 2

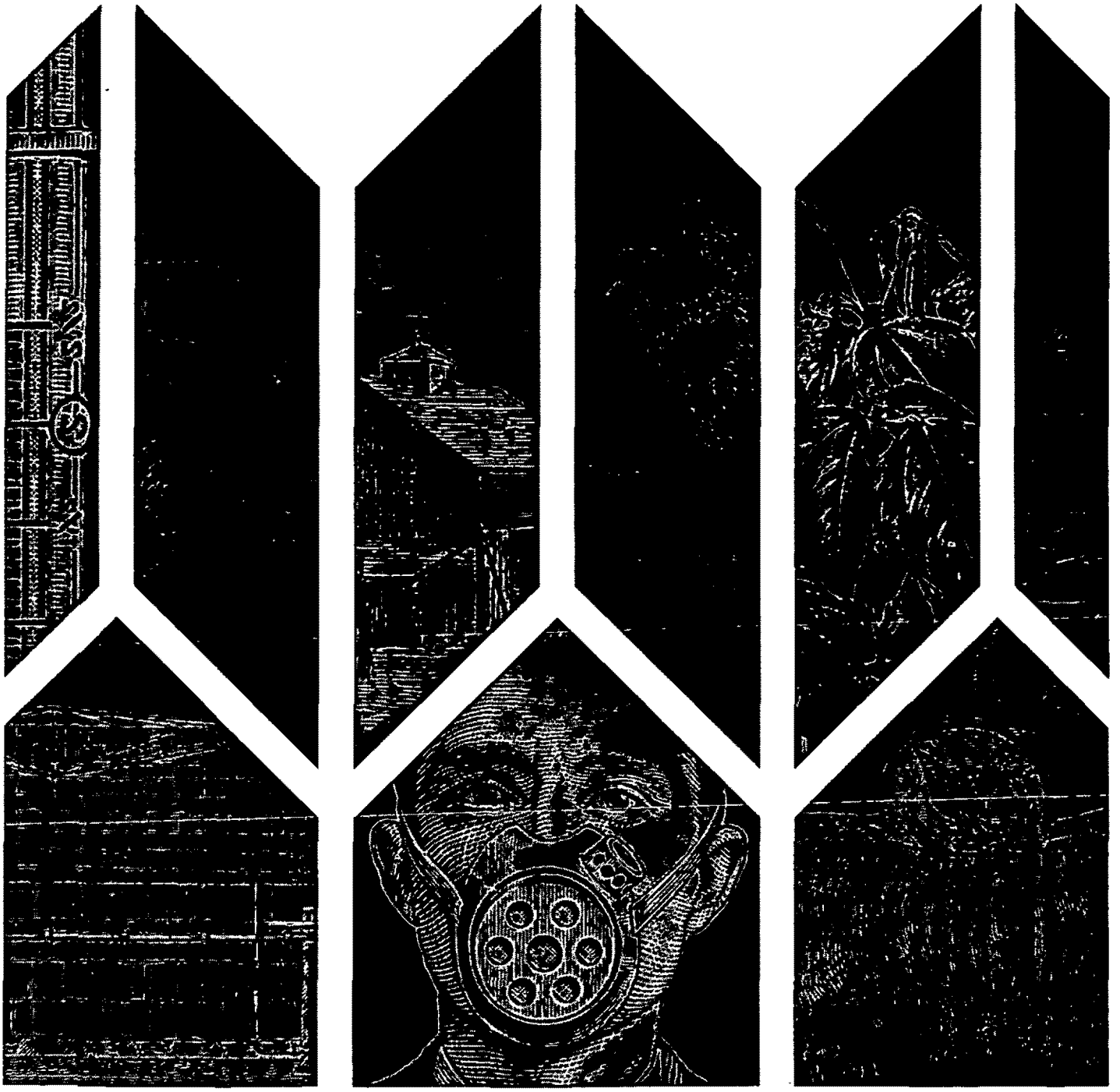
A Report of the Pew Commission on Industrial Farm Animal Production, *Putting Meat on the Table: Industrial Farm Animal Production in America* (April 29, 2008)

A Project
of The Pew
Charitable Trusts
and Johns Hopkins
Bloomberg School
of Public Health

Putting Meat on the Table: Industrial Farm Animal Production in America

Executive Summary

A Report of the Pew
Commission on Industrial
Farm Animal Production



Putting Meat on the Table:

Industrial Farm Animal Production in America

Executive Summary

CONTENTS

Executive Summary

The Pew Commission on Industrial Farm Animal Production was established through a grant from The Pew Charitable Trusts to The Johns Hopkins Bloomberg School of Public Health to recommend solutions to the problems created by concentrated animal feeding operations in four primary areas: public health, the environment, animal welfare, and rural communities. The Commission heard approximately 54 hours of testimony from stakeholders and experts, received technical reports from academics from institutions across the country, and visited operations in Iowa, California, North Carolina, Arkansas, and Colorado, to gather information on each of the subject areas. In addition, each of the Commissioners brought his or her own unique experiences and expertise to bear during Commission deliberations.

Over the past 50 years, the production of farm animals for food has shifted from the traditional, extensive, decentralized family farm system to a more concentrated system with fewer producers, in which large numbers of animals are con□ned in enormous operations. While we are raising approximately the same number of swine as we did in 1950, for example, we are doing so on signi□cantly fewer, far larger farms, with dramatically fewer farm workers. This production model□ sometimes called industrial farm animal production□ is characterized by con□ning large numbers of animals of the same species in relatively small areas, generally in enclosed facilities that restrict movement. In many cases, the waste produced by the animals is eliminated through liquid systems and stored in open pit lagoons.

The ifap system, as it exists today, too often concentrates economic power in the hands of the large companies that process and sell the animal products,

instead of the individuals who raise the animals. In many cases, the □open market□for animal products has completely disappeared, giving the farmer only one buyer to sell to, and one price to be received.

In addition to raising animals in closer proximity, steps were taken to streamline the process of raising animals for food, including standardized feed for rapid weight gain and uniformity; genetic selection to accentuate traits, such as leanness, that create uniform meat products; and mechanization of feeding, watering, and other husbandry activities. This streamlined processing and standardization is typical of the evolution of industrial pursuits, and is intended to be more economical by lowering the amount of input required to achieve a marketable product, as well as to ensure a uniform product. This process in food animal production has resulted in farms that are easier to run, with fewer and often less-highly-skilled employees, and a greater output of uniform animal products. However, there are unintended consequences of this type of animal production.

This transformation, and the associated social, economic, environmental, and public health problems engendered by it, have gone virtually unnoticed by many American citizens. Not long ago, the bulk of the fruit, grain, vegetables, meat, and dairy products consumed by the American people were produced on small family farms. These farms once de□ned both the physical and the social character of the US countryside. However, the steady urbanization of the US population has resulted in an American populace that is increasingly disassociated from the production system that supplies its food. Despite the dramatic decline in family farms over the past 50 years, many Americans, until

very recently, continued to think that their food still came from these small farms.

While increasing the speed of production, the intensive con□nement production system creates a number of problems. These include contributing to the increase in the pool of antibiotic-resistant bacteria because of the overuse of antibiotics; air quality problems; the contamination of rivers, streams, and coastal waters with concentrated animal waste; animal welfare problems, mainly as a result of the extremely close quarters in which the animals are housed; and signi□cant shifts in the social structure and economy of many farming regions throughout the country. It was on these areas that the Commission focused its attention.

As previously mentioned, one of the most serious unintended consequences of industrial food animal production (ifap) is the growing public health threat of these types of facilities. In addition to the contribution of ifap to the major threat of antimicrobial resistance (Smith et al., 2002; Smith et al., 2007), ifap facilities can be harmful to workers, neighbors, and even those living far from the facilities through air and water pollution, and via the spread of disease. Workers in and neighbors of ifap facilities experience high levels of respiratory problems, including asthma (Donham and Gustafson, 1982; Donham et al., 1989; Donham et al., 1995; Donham et al., 1985a; Donham et al., 2007; Merchant et al., 2005; Mirabelli et al., 2006a; Mirabelli et al., 2006b; Sigurdarson and Kline, 2006; Thu, 2002). In addition, workers can serve as a bridging population, transmitting animal-borne diseases to a wider population (Myers et al., 2006; Saenz et al., 2006). A lack of appropriate treatment of enormous amounts of waste may result in contamination of nearby waters with harmful levels of nutrients and toxins, as well as bacteria, fungi, and viruses (Nolan and Hitt, 2006; Peak et al., 2007), all of which can affect the health of people both near and far from ifap facilities.

Antibiotics are one type of antimicrobial. Antimicrobials are substances that kill bacteria or suppress their multiplication or growth, and include antibiotics, some minerals, metals, and synthetic agents.

The use of antibiotics for growth promotion began with the poultry industry in the 1940s when it discovered that the use of tetracycline-fermentation byproducts resulted in improved growth (Stokstad, 1954; Stokstad and Jukes, 1958-1959). Since then, the practice of adding low levels of antibiotics and growth hormones to stimulate growth and improve production and performance parameters has been common among ifap operations for all species. Because any use of antibiotics results in resistance, this widespread use of low-level antibiotics in animals, along with use in treating humans, contributes to the growing pool of antimicrobial resistance in the environment.

The threat from antimicrobial resistance became more apparent in the 1990s as the number of cases of drug-resistant infections increased in humans. A World Health Organization (who) Report on Infectious Diseases published in 2000 expressed alarm at the spread of multi-drug□resistant infectious disease agents, and pointed to food as a major source of antimicrobial-resistant bacteria. Since the discovery of the growth-promoting and disease-□ghting capabilities of antibiotics, farmers, □sh-farmers, and livestock producers have used antimicrobials. This ongoing and often low-level dosing for disease prevention and growth inevitably results in the development of resistance in bacteria in or near livestock because a selective pressure that does not kill fosters resistance (who, 2000).

While it is dif□cult to measure what percent of resistant infections in humans are caused by antimicrobial use in agriculture as opposed to other settings, it can be assumed that the wider the use of antimicrobials, the greater the chance for the development of resistance. Reports on the amount of antibiotics used in animals range from 17.8 to 24.6 million pounds per year. The Union of Concerned Scientists estimates that 70% of the antibiotics used in the United States annually are used in farm animals (Mellon et al., 2001).

As the amount of antimicrobials present in the general environmental pool becomes greater, so too does the chance of resistance developing within many different bacterial populations. This is due, in part, to the way resistance is spread between capable bacteria. For example, many bacteria live in the human digestive tract or on human skin. These are not normally harmful (and are often helpful). However, these harmless bacteria may still

be capable of passing resistance to other bacteria that are harmful, or could then become harmful.

Feed formulation further influences risks because the feeds supplied to confined animal populations are significantly different from the foraged feeds traditionally available to poultry, swine, or cattle.

ifap not only causes concerns about the health of the animals present, but the basic production model creates concerns with respect to human health, as well. Health risks are a function of exposure, with those engaged directly in livestock production typically having more frequent and more concentrated exposures to chemical or infectious agents, and others, such as those involved in support services, having lower rates of exposure. Health risks may extend far from the ifap facility, however. Groundwater contamination, for example, can extend throughout the aquifer, affecting drinking water supplies far from the source of contamination. Infectious agents arising in ifap facilities may be transmissible from person to person in a community setting and well beyond. An infectious agent that originates at an ifap facility may persist through meat processing and contaminate a consumer meat product, resulting in a serious disease far from the ifap facility.

Agricultural workers may serve as a bridging population between their communities and animal confinement facilities. Because it is categorized as an agricultural process, ifap is largely exempt from state and federal industrial exposure monitoring, inspection, injury/disease reporting, and surveillance. Without monitoring, it is extremely difficult for public health officials to reduce the occupational health risk associated with ifap.

The toxic gases and organic dusts associated with ifap facilities have the potential to produce upper respiratory irritation in confinement facility workers. The emissions from confinement facilities, however, may affect communities proximate to those facilities, as well as populations far away from these operations. In particular, the elderly, those with compromised respiratory systems or chronic conditions that limit their mobility, and children are at most risk of asthma and other respiratory illnesses. Depression and other symptoms have also been attributed to emissions from such facilities (Schiffman et al., 1995).

As with the public health impact, much of ifap's environmental impact stems from the tremendous quantities of animal waste that are concentrated in and around ifap facilities. Animal waste in such volumes may exceed the capacity of the land to absorb the nutrients and attenuate pathogens. Thus, what could be a valuable byproduct becomes a waste that must be disposed of in an appropriate manner.

In addition, many ifap facilities have not been sited in areas that are best able to cope with these enormous amounts of nutrients and pathogens. Many are found in vulnerable locations, such as on flood plains or close to communities that utilize well water.

The annual production of manure produced by animal confinement facilities exceeds that produced by humans by at least three times (epa, 2007). Manure in such large quantities carries excess nutrients, chemicals, and microorganisms that find their way into waterways, lakes, groundwater, soils, and airways. Excess and inappropriate land application of untreated animal waste on cropland contributes to excessive nutrient loading and, ultimately, eutrophication of surface waters.

ifap runoff also carries antibiotics and hormones, pesticides, and heavy metals. Pesticides are used to control insect infestations and fungal growth. Heavy metals, especially zinc and copper, are added as micronutrients to the animal diet. Tylosin, a widely used antibiotic (macrolide) for disease treatment and growth promotion in swine, beef cattle, and poultry production, is an example of a veterinary pharmaceutical that decays rapidly in the environment, but can still be found in surface waters of agricultural watersheds (Song et al., 2007).

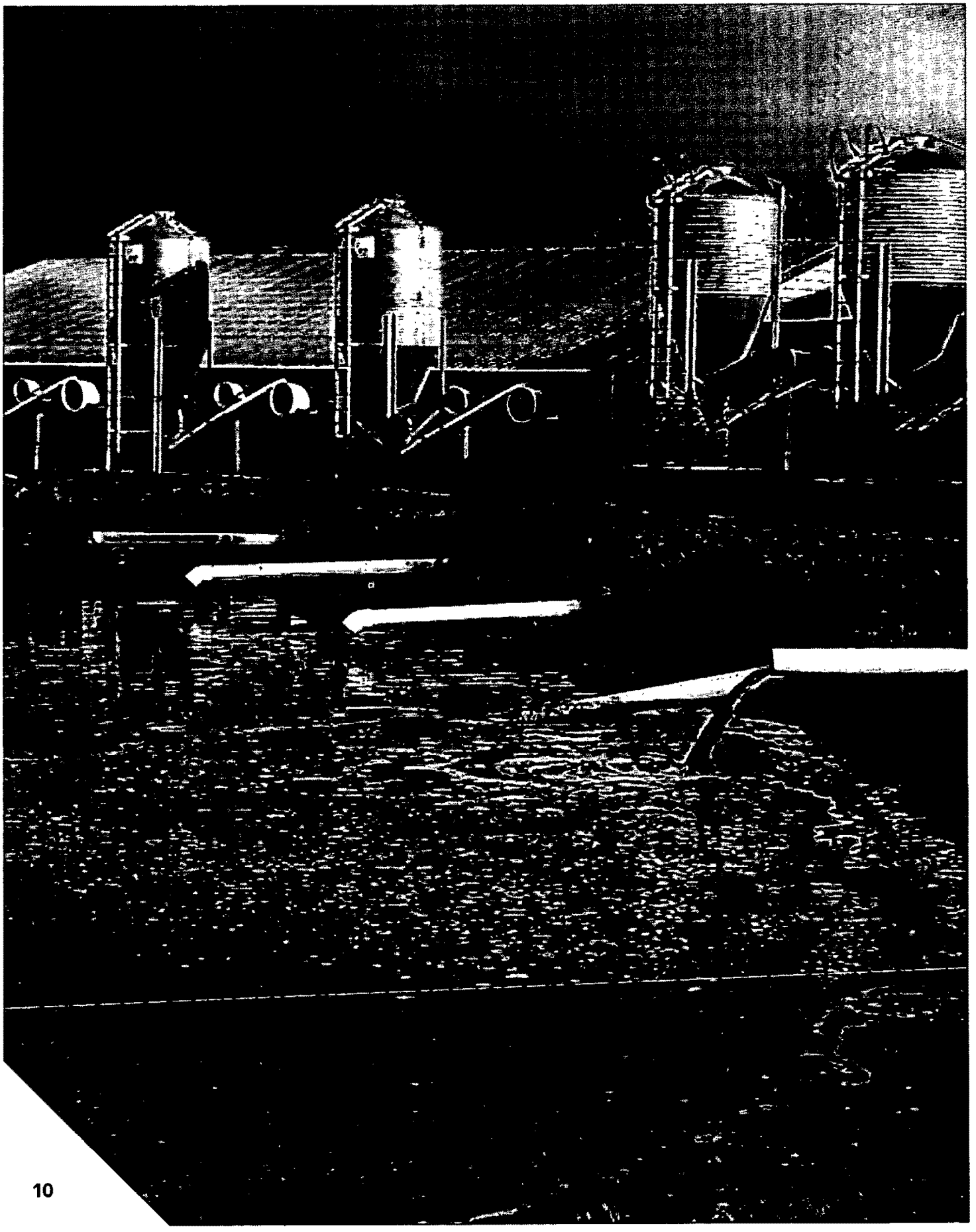
Air quality degradation is another problem in and around ifap facilities, due to localized releases of toxic gases, odorous substances, particulates, and bioaerosols containing a variety of microorganisms and human pathogens (Merchant et al., 2008).

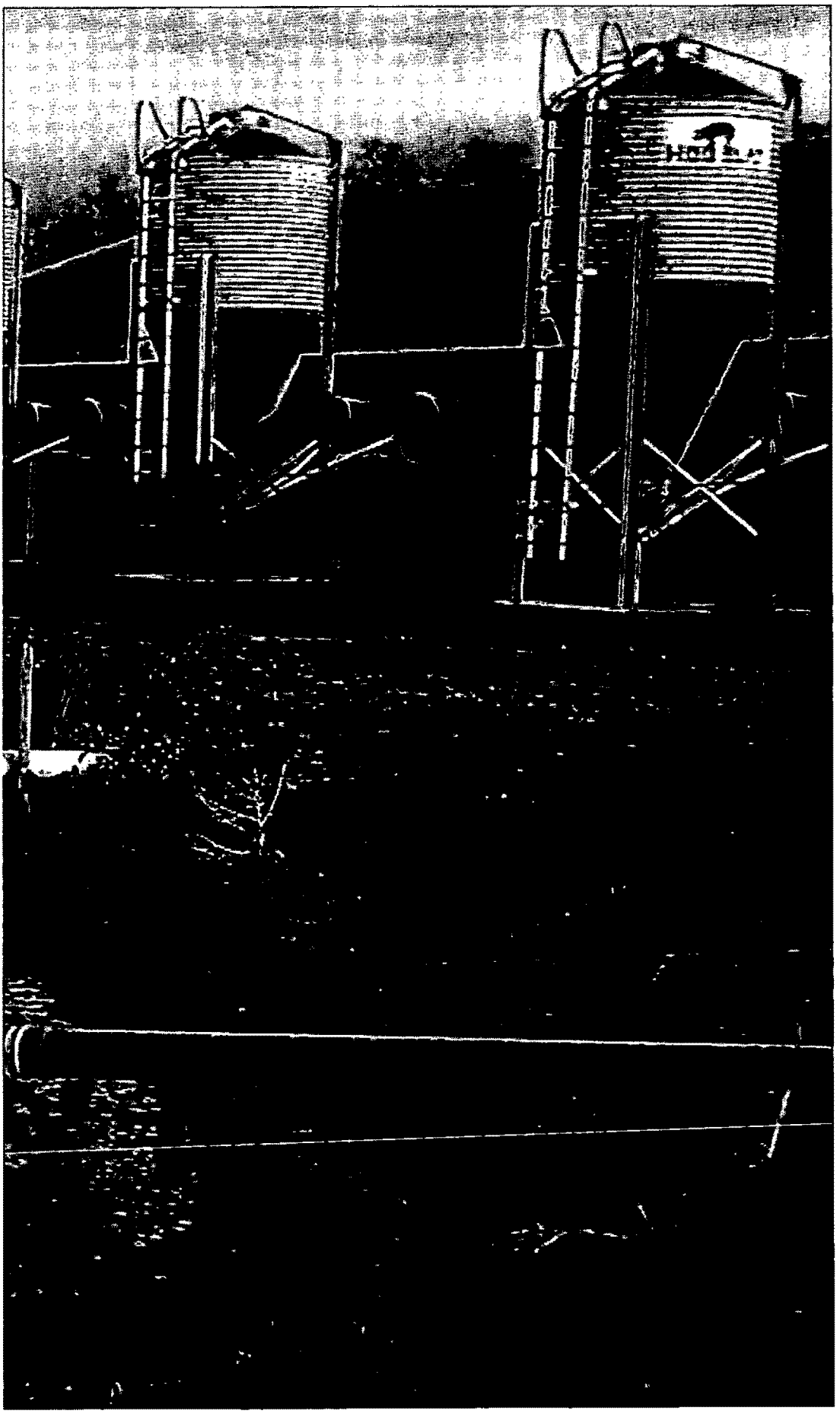
Other environmental issues associated with ifap include high levels of resource use. ifap requires a large amount of water for irrigation of animal feed crops, as well as cleaning of many buildings and waste management systems. Much of this water comes from finite groundwater sources that recharge slowly or not at all, and are in demand for human needs. Greenhouse gas emissions from all livestock operations, including ifap facilities, account for 18 percent of all human-caused greenhouse gas emissions, exceeding the emissions caused from the transportation sector (Steinfeld et al., 2006). Greenhouse gases, primarily methane, carbon dioxide, and nitrous oxide, are produced by the animals during the digestion process in the gut. Additional emissions result from degradation processes occurring in uncovered waste lagoons and digesters.

ifap, as practiced today, is also extremely energy intensive and requires disproportionately large inputs of fossil fuels, industrial fertilizers, and other synthetic chemicals. For example, the ratio of fossil fuel energy inputs per unit of food energy produced averages 3:1 for all US agricultural products combined. For industrially produced meat products, the ratio can be as high as 35:1 (beef produced in feedlots generally has a particularly unfavorable energy balance) (Horrigan et al., 2002).

In the ifap system, each individual farm animal requires less feed, produces less manure, and reaches market weight far faster than farm animals produced on the small family farm of 50 years ago, which might suggest a lesser impact on the environment. Yet ifap stands in sharp contrast to the more pastoral animal farming methods it has replaced by virtue of the emphasis placed on producing large numbers of animals in close confinement, as rapidly and as cheaply as possible. Until ifap, agricultural practice and animal husbandry evolved over more than 10,000 years, and proved to be more or less sustainable as measured by the agricultural inputs and outputs and ecosystem health. ifap systems, on the other hand, are a recent development, dating back approximately 50 years. Rather than seeking a balance between the natural productivity of the land to produce crops to feed animals and absorb wastes produced by those animals, the industrial model concentrates on growing animals as units of protein production. Inputs of feed and feed additives containing antimicrobials ensure that the animals make it to market weight in the shortest period of time possible. Both animals and their waste are concentrated and usually exceed the capacity of the land to produce feed or absorb the waste. Consequently, the rapid ascendance of ifap has produced an expanding array of deleterious environmental effects on local and regional water, air, and soil resources.

The Commission's recommendations include focusing on appropriate regulation of ifap facilities in order to prevent further degradation of air, water, and soils, and to minimize the impact on adjacent communities.





Lagoon waste management system for a 900-head hog farm in Georgia.

ifap methods for raising food animals have produced concern and debate over just what constitutes a decent life for animals and what kind of life we owe the animals in our care. Physical health as measured by absence of some diseases or predation, for example, may be enhanced through con□nement since the animals may not be exposed to certain infectious diseases or sources of injury that would be encountered if the animals were raised outside of con□nement. It is clear, however, that good animal welfare can no longer be assumed based only on productivity or the absence of disease. The Commission looked at the issue of animal welfare from both a scienti□c and an ethical point of view.

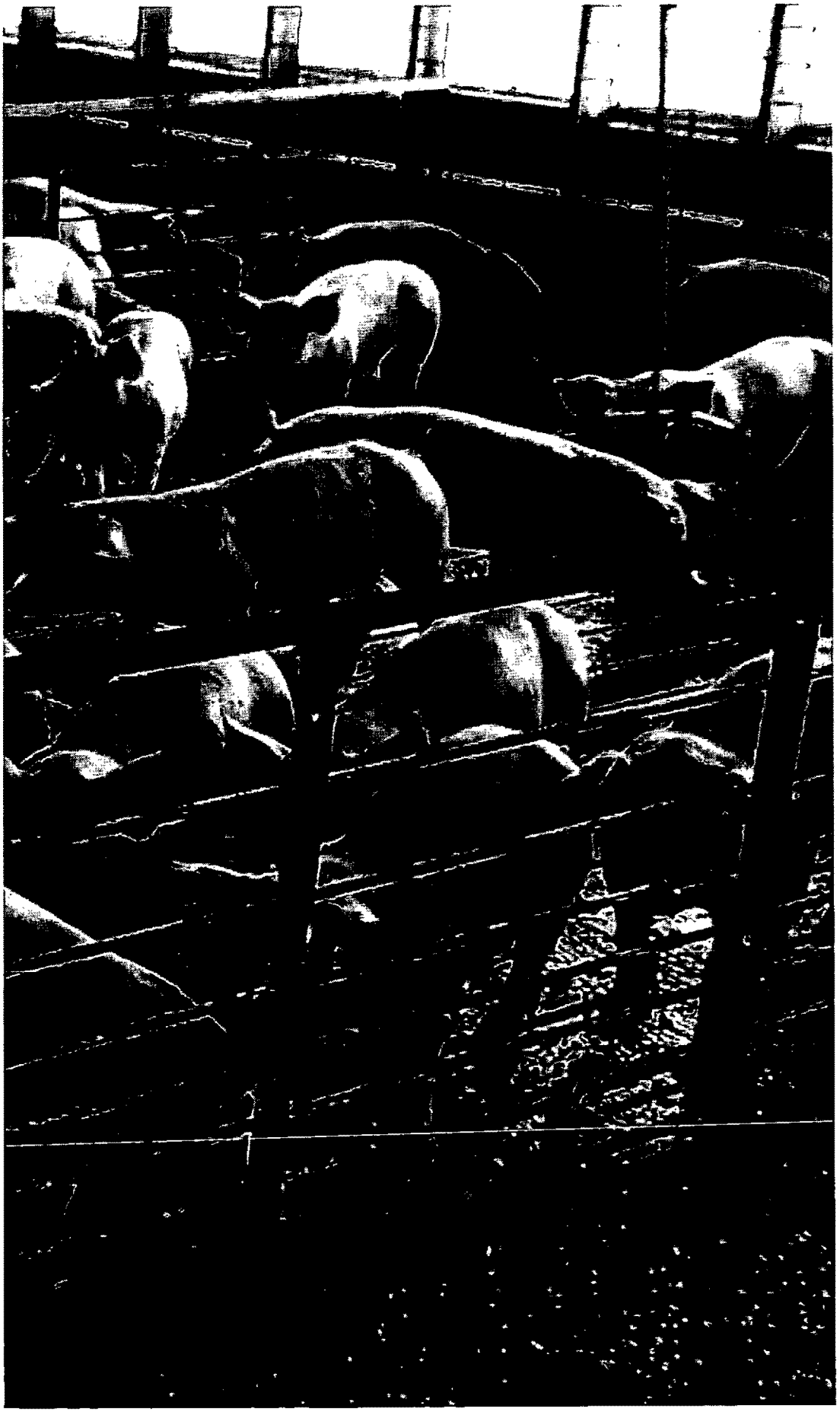
The intensive con□nement practices that are common in ifap so severely restrict movement and natural behaviors that the animal may not be able to turn around or walk at all. Gestation and restrictive farrowing crates for sows and battery cages for laying hens are examples of this type of intensive con□nement. The stress that results from these situations can result in animals that are more susceptible to disease and more likely to spread disease (Barham et al., 2002; Jones et al., 2001; Kanitz et al., 2002; Losinger and Heinrichs, 1997; Silbergeld et al., 2008). In addition, extremely large group size in an extremely con□ned area, such as may be seen in broiler houses, can cause the same types of problems. There are alternatives to these types of production systems, including □cage-free□systems for laying hens, and hoop barns, pens and several less restrictive farrowing systems for hogs. These alternatives can also attenuate many of the health and environmental problems caused by ifap by naturally spreading the manure over the land in manageable amounts and lessening the animal's susceptibility to disease (and therefore the need for much antibiotic use).

Increasing public awareness of the conditions prevalent in con□nement agriculture has led to increased consumer demand for changes in treatment. In anticipation of potentially stronger measures imposed through the regulatory process, the food animal industry has begun to adopt minimum standards of animal treatment codi□ed in voluntary standards that are widely published. In some cases, a third party certi□es them. Such standards, however, rarely address the larger concerns for animal well-being relating to freedom of movement and humane treatment in con□nement systems and slaughter.

Con□nement animals are generally raised indoors and, in some cases (e.g., poultry, laying hens, hogs), the group size when raised indoors is larger than the group size when raised outdoors. In other cases (e.g., veal crates or gestation crates for sows), animals are separated and con□ned to spaces that provide for only minimal movement. The fundamental welfare concern is the ability of the animal to express natural behaviors: rooting and social behavior for hogs, walking or lying on natural materials, and enough □oor space to move around with some freedom at the minimum. Gestation crates, the most restrictive farrowing crates, battery cages, and other intensive con□nement systems fail to allow for even these minimal natural behaviors.

Recently, animal scientists in Europe published a set of standards to de□ne basic animal welfare measures. These include □ve major categories, which must be taken in their entirety: feeding regimens that ensure that animals do not experience prolonged hunger or thirst; housing that ensures resting comfort, a good thermal environment, and freedom of movement; health management that prevents physical injury, disease, and pain; and appropriate means to allow animals to express non-harmful social behaviors, and other, species-speci□c natural behaviors (European Union Animal Welfare Quality Program: http://www.welfarequality.net/everyone/36059)(fawc, 2007). The animal industry has resisted codifying these standards as common practice for fear of adding new costs to animal production processes.

The Commission believes that ethical treatment of animals raised for food is essential to, and consistent with, achieving a safe and sustainable system for producing food animals. Practices that restrict natural motion, such as sow gestation crates, induce high levels of stress in the animals and threaten their health, which in turn may threaten human health. There is growing public concern for ethical treatment of farm animals that will lead to new laws and regulations governing farm animal treatment unless the industry voluntarily adopts third-party, consensus-based standards for animal well-being. The recommendations made by the Commission are intended to de□ne ethical treatment of animals and what constitutes a decent life for food animals.



Large animal confinement operation in Lafayette County, Wisconsin.

Life in rural America has long been challenged by persistent poverty. The causes are many, but among them is the lack of economic diversity in rural economies. Workers have few options in the event of a plant closure or other dislocation, and unemployment rates are high. Consequently, local economic development of□cials frequently consider i f a p an attractive new source of economic opportunity. But higher rates of poverty are equally prevalent in areas of high i f a p concentration, an association con□rmed by Durrenberger and Thu's □nding of higher rates of food stamp use in Iowa counties with industrialized hog production (Durrenberger and Thu, 1996).

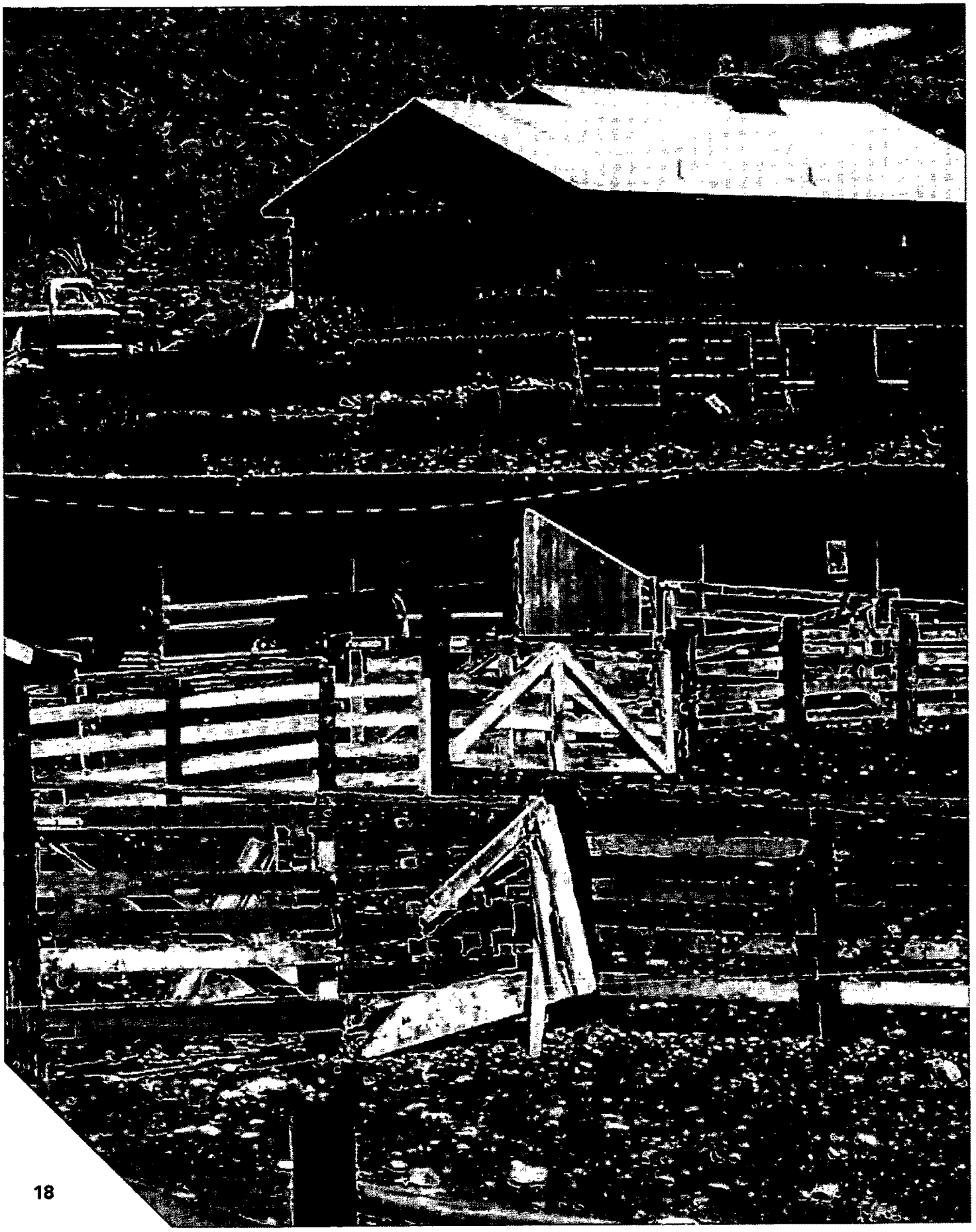
The industrialization of American agriculture has transformed the character of agriculture itself and, in so doing, the face of rural America. The family-owned farm producing a diverse mix of crops and food animals is largely gone as an economic entity, replaced by ever-larger industrial farms producing just one animal species or growing just one crop, and rural communities have fared poorly. Industrialization has been accompanied by increasing farm size and gross farm sales, lower family income, higher poverty rates, lower retail sales, lower housing quality, and lower wages for farm workers.

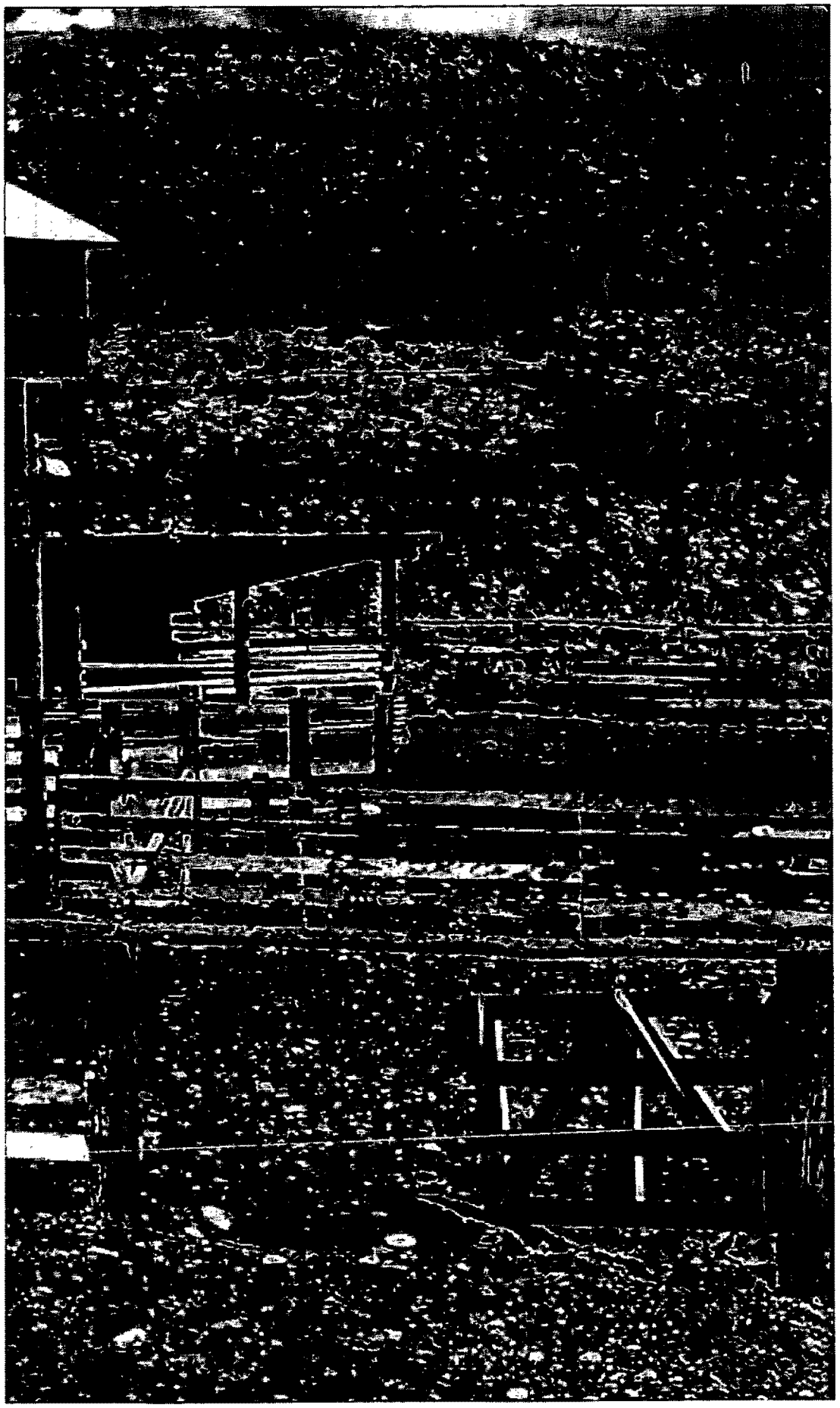
As the food animal industry shifted to a system with a reduced number of companies for livestock producers to sell to, as well as one controlled by production contracts, economic power shifted from farmers to livestock processors. Farmers relinquished their once-autonomous animal husbandry decision-making authority in exchange for contracts that provide assured payment but require substantial capital investment. Once the commitment is made to such capital investment, many farmers have no choice but to continue to produce until the loan is paid off. Such contracts make it nearly impossible for there to be open and competitive markets for most hog and poultry producers, who must enter into contracts with the so-called integrators (meat packing companies) if they are to sell their product.

Although the proponents of the industrialization of livestock agriculture point to the increased economic ef□ciency of i f a p operations, the Commission is concerned that the bene□ts may not accrue in the same way to the rural communities where these operations exist. The Commission's technical report on economics in swine production showed that the current method of intensive swine production is only economically ef□cient due to the externalization of costs associated with waste management. In fact, industrialization leading to corporate ownership actually draws investment and wealth from the communities in which speci□c i f a p facilities are located (Abeles-Allison and Connor, 1990).

Merely tweaking our mono-culture con□nement farm animal production methods is not likely to reverse the negative impacts on public health, environment, animal welfare, and rural America. At the same time, the Commission believes that there are practical solutions to these problems that can start immediately that will ensure that the productivity of farm animal production can be maintained well into the future. Recommendations address criteria for proper siting of i f a p facilities, increasing market competition, and fairness in production contracts in an effort to improve life in rural America. The Commission does not believe that the nation's demand for food can be met by turning back the clock to the 1950s. At the same time, there is much that can be done to address the problems that industrialization of agriculture has brought. The system of the future may be a mix of small and medium-sized extensive operations as well as large, more humane, sustainable intensive operations such as hoop barns in swine production and intensive rotational grazing in beef production.

There is increasing urgency to chart a new course. Our energy, water, and climate resources are undergoing dramatic changes that, in the judgment of the Commissioners, will require agriculture to transition to much more biologically diverse systems, organized into biological synergies that exchange energy, improve soil quality, and conserve water and other resources.





Small farm in Kremmling, Colorado

Executive Summary

Recommendations of the Commission

ifap systems are largely unregulated, and many practices common to this method of production threaten public health, the environment, animal health and well-being, and rural communities. The use of antibiotics in animals without a diagnosed illness, the mismanagement of the large volumes of farm waste, and the treatment of animals in intensive operations are all of deep concern. The Commission's six primary recommendations address these concerns.

Phase Out and Then Ban the Nontherapeutic Use of Antimicrobials

The use of antibiotics and other antimicrobials as growth promoters and in the absence of a diagnosed illness in industrial animal operations is a common practice. In 1998, the National Academies of Science (nas) estimated that antibiotic-resistant bacteria increased health care costs by a minimum of $5 billion annually, or approximately $13 per person, per year (iom, 1998). The next year, the nas estimated that eliminating all antimicrobials as feed additives would cost each American consumer less than $10 per year (nas, 1999).

The Commission recommends phasing out and then banning the non-therapeutic use of antimicrobials in food animal production. The Commission defines non-therapeutic as any use of antimicrobials in food animals in the absence of clinical disease or documented disease exposure.

The Commission recommends that the first step in this process should be an immediate ban on any new approval of antimicrobials for non-therapeutic uses in food animals and retroactive investigation of antimicrobials previously approved.

Improve Disease Monitoring and Tracking

A voluntary animal tracking system, called the National Animal Identification System (nais), has been implemented by the Animal Plant and Health Inspection Service (aphis) of the United States Department of Agriculture. The goal of the nais voluntary system is a 48-hour track back to identify exposures, since that time frame is vital to containing the spread of infection (usda and aphis, 2006).

The first two phases of the nais are the registration of premises and individual animals or units of animals using a US Animal Identification Number (usain) (usda, 2005). According to the usda, the usain will evolve into the sole national numbering system for the official identification of individual animals in the United States. The Commission views animal identification as an important public health issue. The need for a rapid, accurate trace back system to protect public health in the event of a disease outbreak is critical.

The Commission recommends the implementation of a disease monitoring program for food animals with a 48-hour track back of those animals at every stage of production in a fully integrated and robust database. A mandatory premise and individual animal or lot registration should be in effect by 2009, with an animal tracing capability in place by 2010. The tracking system should follow food animals from birth to consumption, including movement, illness, breeding, feeding practices implemented, slaughter condition and location, and point of sale.

Federal agency oversight of all aspects of this tracking system with stringent protections from lawsuits for producers is needed. Special funding allocated to small farms to facilitate their participation in the national tracing system is vital.

Improve IFAP Regulation

Waste from ifap operations contains both desirable and undesirable byproducts. Farm waste can be a soil-enriching nutrient when applied in the correct amount and with the right method. But undesirable components of animal waste include pathogenic organisms, antibiotic-resistant bacteria, viruses, industrial chemicals, and heavy metals.

As ifap facilities have become more concentrated in speci□c geographic areas around the country, dealing with waste issues has become critical. New regulations must address zoning and siting of ifap facilities with particular consideration of topography, climate, and population density of a proposed region. New ifap laws and regulations must mandate development of sustainable waste handling and treatment systems that can utilize the bene□cial components, but render the less desirable components benign.

The Commission recommends that ifap be regulated as rigorously as other industrial operations, and that a new system of laws and regulations for dealing with farm waste replace the in□exible, patchwork, and broken systems that exist today. Congress and the federal government should work together to formulate laws and regulations outlining baseline waste handling standards for ifap facilities. These standards would address the minimum level of mandatory ifap facility regulation and would outline what ifap regulations states must carry out to prevent pollution and to protect public health and the environment.

Phase Out Intensive Confinement

Animals that are raised for human consumption, even under the best of circumstances, are subject to treatment at some point during their lives that causes them pain. Over the past 50 years, there has been a gradual movement away from raising animals in extensive, pasture-based systems to more intensive, con□ned systems. Not all of the systems that employ such practices are classi□ed as □c a fo □s, as intensive con□nement can occur in facilities that are not big enough to be classi□ed in that manner. Although the result of this change has been improved speed of production, conditions in many facilities are particularly harsh and stressful, and in many cases may cause undue suffering throughout much of an animal's entire life.

Unbeknownst to most Americans, no federal regulations protect animals while on the farm. The Humane Methods of Slaughter Act was enacted to ensure that animals are rendered □insensible to pain□before slaughter, but poultry are not included under its protection despite the fact that more than 95 percent of the land animals killed for food in this country are birds.

Industry standards for production systems and animal care are generally guided by economics. Welfare issues, such as animal stress and suffering, might be considered in rearing, but only in the context of how they impact performance, ef□ciency, or pro□tability. Industrial livestock production systems have often deleteriously affected the welfare of virtually every species of farm animal in the United States, [including all forms of poultry (chickens, turkeys, ducks, and geese), dairy cows, veal calves, swine, sheep, and lambs], and raise serious ethical questions regarding the way in which these animals are treated.

The Commission recommends the phase-out, within ten years, of all intensive con□nement systems that restrict natural movement and normal behaviors, including swine gestation crates, restrictive swine farrowing crates, cages used to house multiple egg-laying chickens, commonly referred to as battery cages, and the tethering or individual housing of calves for the production of white veal. In addition, the Commission recommends the end to force-feeding of fowl to produce foie gras, tail docking of dairy cattle, and forced molting of laying hens by feed removal. Due to the capital investment in these intensive con□nement systems by many contract producers, particularly in swine production, the Commission recommends targeted assistance be made available to contract producers to facilitate the conversion from intensive con□nement systems, either through accelerated depreciation or some other mechanism.

Increase Competition in the Livestock Market

The transformation of rural society and the farm economy in many agricultural regions of the country over the past three or four decades has been profound. With the increasing consolidation of agriculture, including livestock production, and the transition to ever larger units of production, small to mid-size family farms in which agricultural activities account for the bulk of family income have rapidly disappeared throughout the nation. Each year, the number of people engaged in agriculture in America grows smaller. What was once a richly textured way of life supported by countless small town businesses and a corresponding network of health, education, and social services that were once prevalent throughout many rural areas, has been dramatically altered. Quite literally, rural life in many parts of the nation has withered, leaving once thriving farm communities with an increasingly ghostlike appearance.

There are multiple factors behind the changing face of rural American society, the rise of industrialized agriculture being only one. However, the increasing concentration and integration of the livestock production process from breeding and insemination to slaughter, processing, and the distribution and sale of meat and dairy products raises issues associated with competitive fairness and economic life in rural areas that continue to spark passionate debate throughout rural America, and which are the subject of increasing rancor and confrontation.

The Commission believes that vigorous market competition is of vital importance to consumers and the overall health of the American economy. The nation bene□ts from an open, competitive, and fair market where the values of democracy, freedom, transparency, and ef□ciency are in balance.

The Commission recommends the vigorous enforcement of current federal antitrust laws to restore competition in the farm animal market. If enforcing existing anti-trust laws is not effective in restoring competition, further legislative remedies should be considered, such as more transparency in price reporting and limiting the ability of integrators to control the supply of animals for slaughter.

Improve Research in Animal Agriculture

ifap can have a dramatic impact on health, on the environment, and certainly on the lives of the animals themselves. As the Commission traveled across the country, meeting with experts in animal agriculture, the general public, and stakeholders, it heard the recurring theme of the need for independently funded research. The strongest comments came from the academic research community.

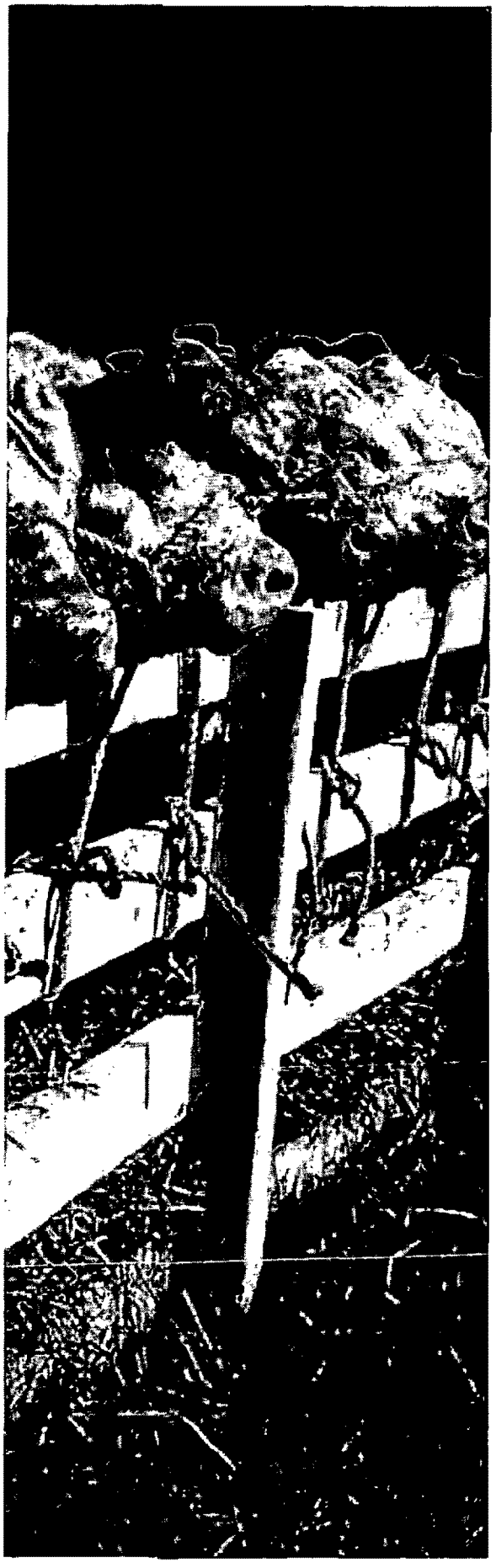
The three main areas of concern were:

- *The lack of public funding for research into ifap* issues.
- The increase in research funding by members of the animal agriculture industry.
- The lack of transparency in funding sources in much agricultural research.

With declining public research dollars, investigators turn to other funding sources. Increasingly, those sources are the giant multinational agricultural companies that have a vested interest in positive □ndings. Certainly, companies may want to fund research to help them improve their business, but if such funding is the major source for research, that funding source should be reported. The same may be said if an advocacy organization is the majority funder.

This transparency is particularly important with university extension programs. These programs are the □on the ground□location where research is □translated□ into practice. Often, a farmer may be told that something is □best□without any awareness of who funded the research that backs that statement. They may then employ, in good faith, a practice that is not □best,□but instead contributes to the environmental, public health, animal welfare, and community issues.

Increasing public research dollars into ifap should be a major focus, since this form of animal agriculture impacts so many aspects of life. The Commission's effort to gather unbiased information was affected by the industry's undue in□uence on academic researchers. It is extremely unfortunate that this is the case, because with appropriate independent funding, science may be able to solve many of the problems resulting from ifap.



Conclusion

Through public testimony from stakeholders, site visits, presentations from experts, technical reports, and the experience and expertise of the Commissioners themselves, the Commission has compiled these recommendations (as well as the more detailed recommendations found in the full report) for improving the sustainability of animal agriculture into the future. The Commission firmly believes that many of the problems associated with factory farming are unintentional, but that does not mitigate the need to move forward in a positive direction. Failure to address these issues will only result in a further lack of confidence in the animal agriculture industry, increased environmental damage, worsening public health, dismal animal welfare, and a grave outlook for rural communities. In this age of increased awareness of the need for economically and environmentally sustainable endeavors, animal agriculture cannot be left behind. The Commission applauds the efforts of many enterprises toward this goal and is certain that a better system is around the corner. The recommendations of the Commission provide examples of steps that should be taken to achieve this larger goal.

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Final Report
Acknowledgments

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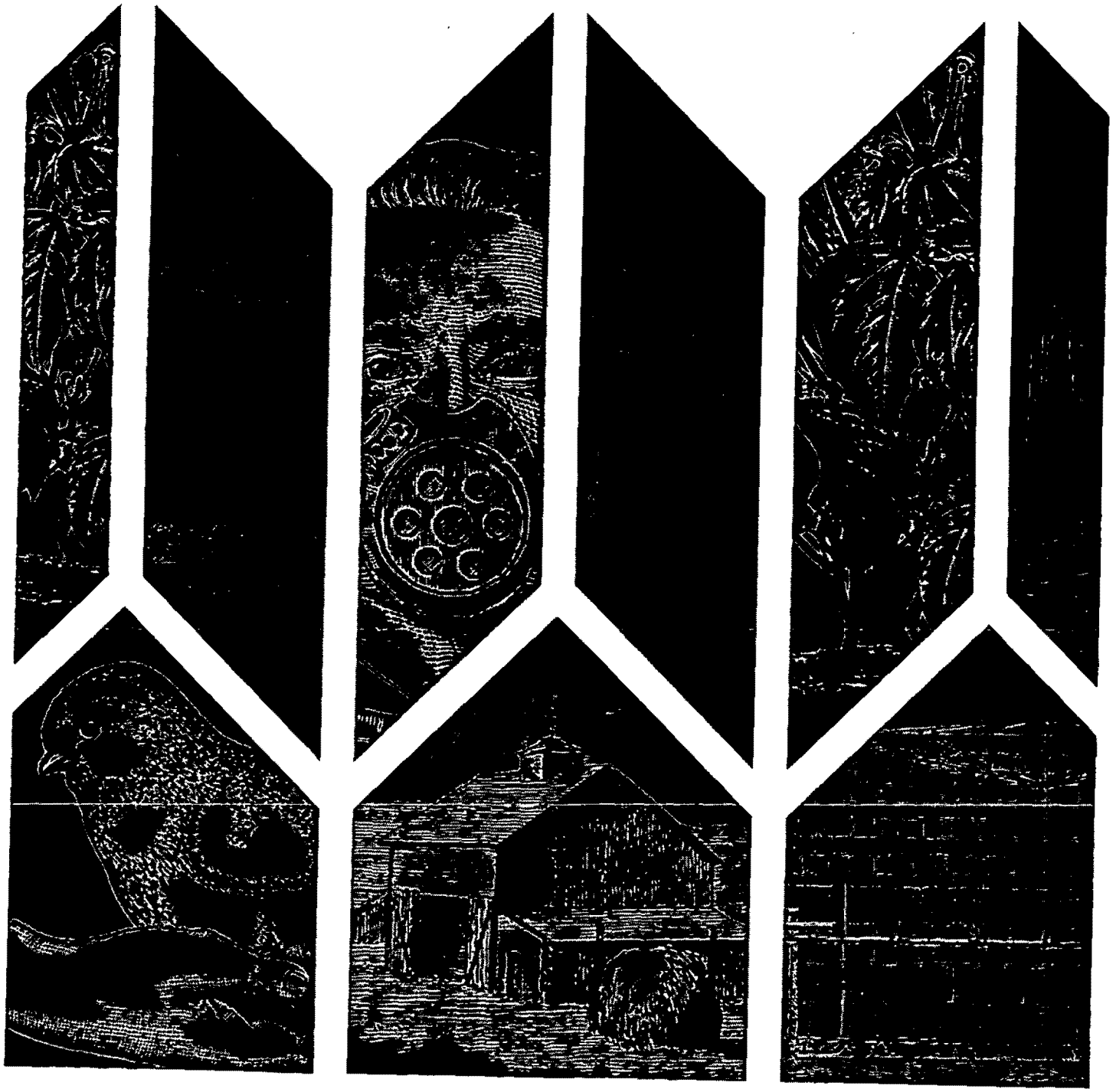

EXHIBIT 3

David Madrid, *Hickman's egg factory planned for Tonopah hatches riff*, Arizona Republic (February 10, 2014)

Hickman's egg factory planned for Tonopah hatches tiff

Residents: Lifestyle will be ruined; Hickman's: We're good neighbors

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RELATED NEWS

Montini: Hickman's expansion no 'yolk' to residents

By David Madrid
The Republic | azcentral.com
Mon Feb 10, 2014 11:31 AM

Hickman's Family Farms will build a farm factory in Tonopah that will open with 2.2 million chickens, and could grow to four times that, despite opposition from residents who say the project blindsided them.

Residents want an environmental-impact study to determine the farm's impact on health and natural resources in the community, which is about 20 miles west of Buckeye.

However, because the land is zoned for agriculture, state agricultural laws allow Hickman's to build the 360-acre farm with few permit requirements and virtually no oversight from the state or Maricopa County.

The District 4 County Supervisor whom residents of the unincorporated area would typically turn to is Clint Hickman, who is part of the family and a co-owner of the business. Hickman said there are four other supervisors residents can contact with concerns about the egg and fertilizer facility.

Signs of opposition line properties along Indian School Road, where the farm will be built. A public meeting last month with the Hickmans drew about 400 residents, most of whom were angry and opposed to the plant.

The residents fear their dream lifestyle become a nightmare that includes chicken feces, flies, dead chickens, truck traffic, noise and air pollution. They worry the giant farm could endanger underground water supplies and hot springs, and about the Hickman's use of prison labor.

The rural community's downtown, with a dozen or so businesses, is just off Interstate 10 at Indian School Road and 411th Avenue. The farm will be at Indian School Road between 415th and 419th avenues.

Billy Hickman, a Hickman's co-owner and vice president of operations, said the company has been responsive

to residents' concerns, but it appears nothing can appease them except the farm changing locations, which he said isn't going to happen.

Hickman's will break ground on the $40 million first phase any day, he said.

The property was selected because of its proximity to the interstate, making it easier and more cost-effective to ship eggs west to California and east to Phoenix and beyond. It also is near a supply of workers, he said.

The company's first phase will include 2.2 million chickens in seven 30-foot-tall buildings, each with a 45,920-square-foot footprint, and a 35,000-square-foot processing plant. Future phases would each have seven buildings that house 300,000 chickens in each, and would boost the farm's chickens to more than 8 million if there are four phases.

Whether those four phases will be built will depend on the demand for eggs, Billy Hickman said.

Prisoners from the Arizona State Prison Complex-Lewis in Buckeye will do some work at the farm. Hickman said he isn't sure how many prisoners will work in Tonopah because they work with baby chicks, and the babies will be born and raised at Hickman's facility in Arlington before being sent to Tonopah.

The company has two other chicken farms, one in Maricopa, south of Phoenix, and another in Arlington, southwest of Buckeye, near the Palo Verde Nuclear Plant.

The first phase of the Tonopah facility would require about 18 trucks per 10-hour day, seven days a week. The trucks would haul feed to the Tonopah facility, and transport out eggs, euthanized chickens and manure. Billy Hickman said that would be fewer than two trucks per hour during the workday, and the truck traffic would benefit a nearby truck stop, one of Tonopah's businesses.

At the contentious public meeting in January, many residents were outraged that they weren't given notice and that there weren't public meetings until after the plan was finalized.

Tonopah leaders say they found out about the project in October when someone asked about the project in a Tonopah Valley Community Council meeting, but they were unable to get details until the Hickmans agreed to meet with them in November.

Billy Hickman said company officials closed on the parcel, for which they paid $10,000 an acre, in November, and informed community leaders nine days later.

Business and land owners say their livelihoods and investments could be destroyed. They point to the Hickmans' chicken and egg farm operation in Arlington, where there have been complaints to the county Air Quality Department about odor and dust.

The Hickmans acknowledge the Arlington plant has problems, but say they will use a different method of chicken farming at the Tonopah farm.

There will be no manure piles outside the Tonopah facility, Billy Hickman said. Chicken feces will be kept inside and shipped out. Chickens past their egg-laying prime will be euthanized and shipped off-site daily to be composted.

He said Hickman's had not commissioned an environmental study, but the facilities will sit on concrete and will not harm water supplies.

Locals oppose farm

The Tonopah Valley Community Council and Tonopah Valley Association, made up of residents, farmers and business owners, oppose the Hickman's operation being placed in Tonopah, which they say is a unique community.

Tonopah is said to mean "hot water under the bush," which refers to its geothermal water heated from the Earth's interior. A subterranean fault is the heat source that provides water to El Dorado Hot Springs, a business half a mile east of the proposed Hickman's facility, manager Matt Kamowski said.

Visitors travel there to soak in the healing waters while taking in the views of Saddle Mountain and the Palo Verde Hills, he said.

"Some people have arthritis problems. Some people have back problems. Some people have joint problems, and they come here to heal," Kamowski said.

He called the mere presence of a giant egg and fertilizer farm a threat to his business. He's concerned about the odor and aesthetics, as well as impact on the water.

Oscar Lopez owns Tonopah Family Restaurant, which is three-quarters of a mile east of the proposed farm. Lopez said customers and truckers from the interstate will bypass the area once word is out about the farm.

"We're going to lose a lot of business," Lopez said, adding that about 70 percent of his business comes from outside Tonopah.

Mike Wirth is a co-owner of the Saddle Mountain RV Park, which was built in 1980 and is home to part-time and permanent residents. Wirth said he and his brother invested millions into the park with 344 RV spaces, 28 apartments, an 11,000-square-foot clubhouse and other amenities.

"I just cannot see how you can have 6 (million) to 8 million chickens within three-quarters of a mile of me and not create an odor or fly problem of some kind," he said.

Wirth's attorney sent letters to the Hickmans and the county Board of Supervisors warning that the farm could be a nuisance and damage the RV park business.

Clint Hickman, who was appointed to the county Board of Supervisors in 2013, said he has been careful to avoid a conflict of interest. He said that he has made it clear to the county that he isn't involved in any county issues concerning the facility.

"I'm more than happy to talk about issues of all sorts and types in the Tonopah area as they come to me, but on something like this where my family and my family company is investing money in the West Valley to expand our operations, I'm very proud of that," Clint Hickman said.

"However I have a role with the county and on something like this that hits so close to home, what I can do is make sure that anyone with any complaints or suggestions needs to talk to the people that will regulate us," he said. "If they have particular questions when it comes to the county, like air quality or something, there are agency heads that exist just for that purpose."

However, until the facility is built and there are complaints, there is no one to regulate the facility.

Few permits required

There are two permits required of Hickman's Family Farms. The company must apply for a floodplain-use permit from the Flood Control District of Maricopa County, because the parcel is affected minimally by a floodplain, said Cari Gerchick, a county spokeswoman.

Based on a preliminary review, none of the proposed structures are affected by the floodplain, so the use permit will be issued, and a final inspection will be done to ensure that the buildings do not affect the floodplain, she said.

The Hickmans also applied for a dust-control permit, which the county Air Quality Department approved Jan. 30. The permit requires the company to keep dust to a minimum when building the facility.

There are no other permits required, according to the state and county.

Billy Hickman said the facility has support among some Tonopah residents, including those who have applied for jobs.

"I don't know that I can please everybody," he said. "Hopefully, we can perform at a level that they're satisfied that ... we're not disrupting their lives."

EXHIBIT 4

Establishment Inspection Report (May 5, 2011)

Establishment Inspection Report	FEI:	3004335866
Hickman's Egg Ranch (Maricopa)	EI Start:	05/05/2011
Maricopa, AZ 85239-4164	EI End:	05/05/2011

SUMMARY

This was the initial inspection of a chicken farm. It was conducted under the LOS-DO FY-11 work plan. The assignment was issued from CFSAN as part of the new Shell Egg Regulations.

The inspection covered the required programs they must have in place: biosecurity, environmental testing, pest-control, refrigeration, pullet-certification, and cleaning-disinfection. Selected records were reviewed and copied for this report. No deficiencies were noted.

There were no refusals. No samples, labels, or photographs were collected. Please address correspondence to Mr. Billy Hickman, Vice-President, Hickman Egg Ranch, 6515 S. Jackrabbit Trail, Buckeye, AZ 85326.

ADMINISTRATIVE DATA

Inspected firm:	Hickman's Egg Ranch (Maricopa)
Location:	12710 N. Murphy Rd., Maricopa, AZ 85239-4164
Phone:	520-568-4118
Mailing address:	6515 S. Jackrabbit Trail, Buckeye, AZ 85326
Dates of inspection:	5/5/2011
Days in the facility:	1
Participants:	John A. Daubenspeck, Investigator

HISTORY, INTERSTATE COMMERCE, JURISDICTION

Hickman's has been in the business of raising laying hens for shell-egg production since 1944. The facility in Maricopa, Arizona, however has only been here about 10 years. There are also farms in Arlington, Arizona. All buildings are registered under [redacted] the Shell-Egg Regulations. There is also an egg-packing plant at this location, USDA # 1711. It was not covered during this inspection.

Approximately [redacted]% of all products made here are sold within Arizona. The remaining are sold to [redacted], [redacted], and [redacted]. Neither Ms. Yeatts nor Mr. Pineda knew the annual volume of sales in dollars, but said that daily, they produce about [redacted] dozen eggs.

The Maricopa facility has [redacted] hen houses with approximately (b)(4) birds total (Exhibit 1). They are double-decker type houses with manure-belt systems. The Maricopa farm sells to (b)(4) and (b)(4), sometimes using the brand (b)(4) (b)(4).

Hickman's is certified by Safe Quality Food (SQF), United Egg Produces (UEP), and the United States Department of Agriculture (USDA).

INDIVIDUAL RESPONSIBILITY

I presented my FDA credentials and a Notice of Inspection (FDA-482) to Ms. Sharl Yeatts, Quality Assurance Technician. She is the most responsible person for the Salmonella Enteriditis Program for all Hickman Farms.

I also presented my FDA credentials to Mr. Shane Jolicoeur, Production Manager. He is the most responsible person for managing the hen houses. They both answer to Mr. Billy Hickman, Vice President, who was not there at the time of the inspection. Other administrative personnel are listed on Exhibit 2. Management meets periodically to review the SE plan and other issues (Exhibit 3).

OPERATIONS & RECORDS

Ms. Yeatts provided me with their Salmonella Enteriditis (SE) plan when I inspected the farms in Arlington. It is the same for the Maricopa facility. Due to length, it is not copied for this report, but can be found under the Arlington North inspection. Hickman's is following the required elements in the shell-egg regulations. They obtain their pullets from SE-free flocks (Exhibit 4).

They have sanitation procedures in place and maintain documentation of those activities (Exhibit 5). This includes equipment disinfection logs, internal inspections, and foot-bath inspections.

Ms. Yeatts provided a copy of their refrigeration records. Temperatures are held below 45° F. (Exhibit 6). Final products (cleaned eggs in cartons) are shipped in refrigerated, cleaned trucks. Some trucks belong to Hickman's, and some belong to other firms, such as (b)(4). Truck thermometers are tested for accuracy.

They also conduct environmental tests during the required ages of the birds, approximately 14 and 45 weeks of age (Exhibit 7). There were no SE positives. Ms. Yeatts said that they had never had an SE positive at any of their farms, including the Maricopa facility.

Mr. Jolicoeur said that they had experienced problems with rodent control over the past few years, but they took corrective action and greatly reduced the rodents in the hen houses. He provided me with a report detailing this action (Exhibit 8).

Ms. Yeatts also provided an example of a fly-index record (Exhibit 9). They said that pesticides are locked in cages and only properly-trained personnel have access to them.

I did not observe any rodents or excessive quantities of live flies during the inspection. I looked at the hen's feeding troughs, cages, and manure-belts, but did not note any excessive filth.

Ms. Yeatts and Mr. Jolicoeur accompanied through the facilities. We walked through houses 1, 3, and 4. They wore dedicated clothing. I wore a disposable bio-hazard suit over my clothes, with a hairnet and shoe coverings. I changed these items before going into each house and threw the used ones in the trash.

WATER & FEED

Hickman's has its own water wells. The water is checked for coliforms and E. coli. These are sent to (b)(4), in (b)(4). Ms. Yeatts said that they use (b)(4) as a water treatment to help control for pathogens in the birds' drinking water. Feed comes from (b)(4)., comprised mostly of (b)(4).

FDA ATTACHMENT A QUESTIONNAIRE

This firm does not have a history with the U.S. Food & Drug Administration. There are no known reports of disease outbreaks from this farm. They said that they have never had an order of diversion.

They are certified by USDA (NPIP, National Poultry Improvement Program), SQF (Safe Quality Food), and UEP (United Egg Producers).

Eggs produced at this plant are for shell-egg production. This farm has [redacted] hen houses (belted) and about (b)(4) birds. They are registered with the FDA under the (b)(3) Egg Rule. This is a family-owned and family-run operation.

Houses are tested for Salmonella enteriditis when birds are 14 to 16 weeks old, and again when 40 to 45 weeks of age. The firm's SE plan describes the testing procedures in more detail. Biosecurity measures, pest-control, record-keeping, and disinfection procedures are also described in the SE plan.

Birds are euthanized (b)(4) [redacted]. They are not used for meat in human food or pet food. The birds are placed in the manure piles and decompose rapidly.

They also pack the eggs at this facility (attached to the egg-conveyor belt), plant # 1711. Eggs are washed, rinsed, and sanitized using (b)(4) [redacted] (b)(4) to help destroy Coliforms and Salmonella.

The USDA inspects the firm's egg-packing plant. Hickman's follows the FDA's Shell-Egg Regulations, which include biosecurity, pullet-rearing, pest-control, cleaning and disinfection, sampling of environmental conditions, and refrigeration requirements.

GENERAL DISCUSSION WITH MANAGEMENT

No FDA-483 (Inspectional Observations) was issued. There have been no complaints of sickness or injury from these eggs. There have been no recalls, but the firm has a recall plan in place (Exhibit 10). No samples, photographs, or labels were collected. There were no refusals.

ATTACHMENTS

FDA-482, Notice of Inspection

EXHIBITS COLLECTED

1. Maricopa facility fact sheet
2. Organizational structure of Hickman's
3. Management review log for March, 2011
4. NPIP records certifying SE pullets
5. Sanitation records, March, 2011
6. Refrigeration log, April, 2011
7. SE test results 14 & 45 week-old hens, September, 2010
8. Corrective action report for rodent-control, March, 2011
9. Fly index report, March, 2011
10. Recall plan for Maricopa farm

John A. Daubenspeck, Investigator

EXHIBIT 5

Site Plan

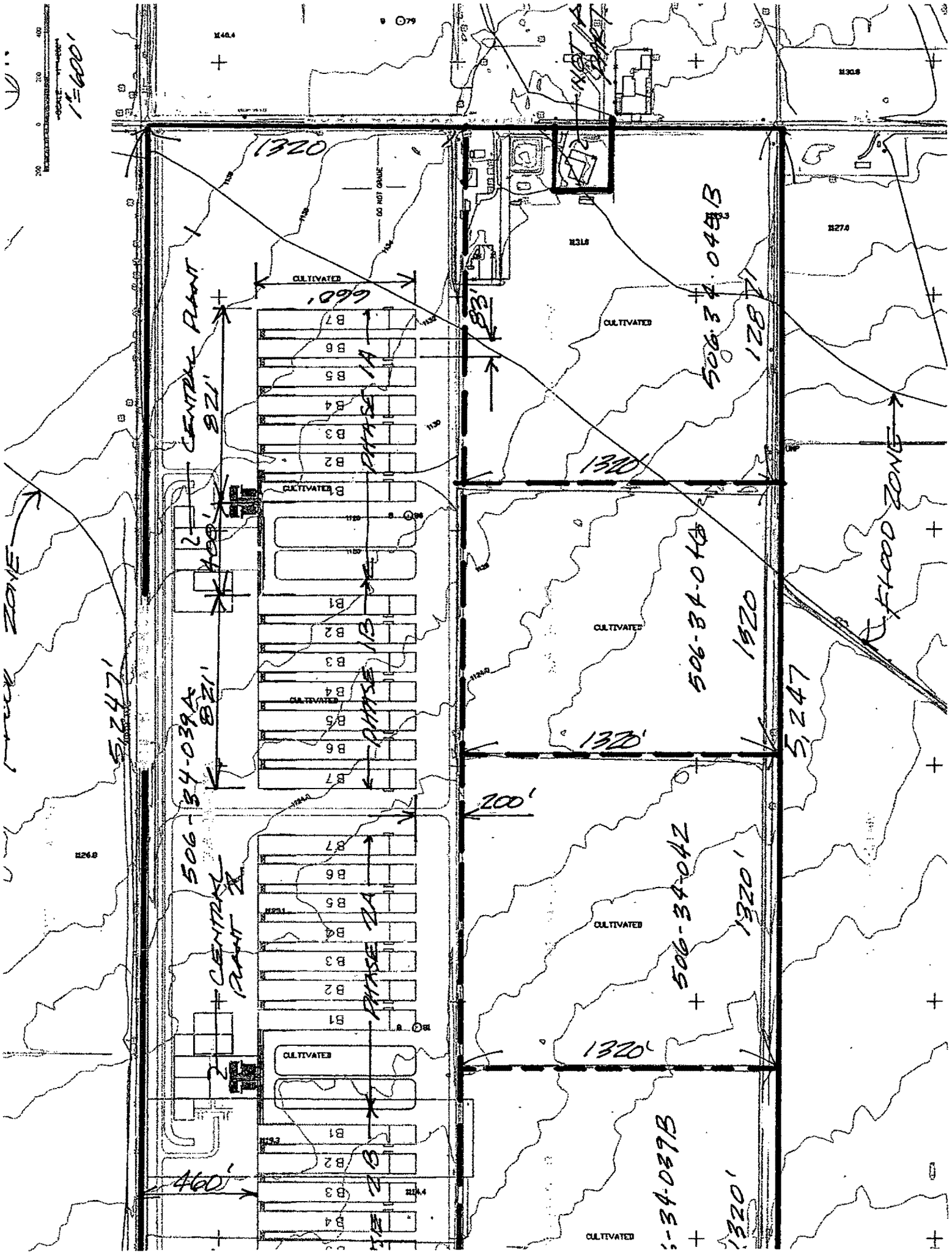
1320
CULTIVATED
1320'
1320'
1320'
1320'
200'
460'
CENTRAL PART
PHASE 1A
PHASE 1B
PHASE 2A
PHASE 2B
CULTIVATED

EXHIBIT 6

Transcript of public meeting on January 9, 2014

HICKMAN'S FAMILY FARMS

Desert Pride Farm - Tonopah, Arizona

COMMUNITY INFORMATION MEETING

Saddle Mountain RV Park
3607 N. 411th Avenue
Tonopah, Arizona

January 9, 2014
6:00 p.m.

PREPARED FOR:

Mr. Michael Wirth

Reported by:
Sheryl L. Henke, RPR
Arizona CCR No. 50745

MR. WIRTH: My name is Mike Wirth. I'm the owner of the Saddle Mountain RV Park. And I just want to introduce the Hickmans. They're going to present their information tonight.

Before we start I just want to thank them for coming. And I also want to show Billy and Glenn the utmost respect from everybody here. If there is anybody using foul language or anything that goes on, we will escort you out. There is security here. I will not put up with it. And nobody in our company will here. So we will ask you to leave.

So please no foul language, no disrespect to these people. They're here to present. And if you yell and scream, they will not be here to be able to get out the information they want to get out. So please be courteous the whole time.

The bathrooms are through that door right there in the next building. There is exits all through here that you can get out of here if you need to get out. If there's anybody here that can give up a seat to an elderly person or somebody that needs a seat, and you're a young person with good strong legs, please do so.

AUDIENCE SPEAKER: There is two empty seats over here.

would mill around and take a look at the different -- the different exhibits, whatever you might call them. And ask the questions of the people that run the -- run those areas. And they are the -- they are the ones that make the Hickman Family Farms work every day. As much as we would like to think we do, it's the people out here in red.

Would you like to say anything before we get started?

MR. GLENN HICKMAN: Only if you're not going to get the mic back.

MR. BILLY HICKMAN: We do this a lot to each other.

MR. GLENN HICKMAN: My name is Glenn Hickman, and I am the president of the Hickman Family Farms company, because I am my mom's favorite. So ours is a family organization. It's our family and a lot of other families that work with us every day. And we're committed to providing safe nutritious food for families.

That's what we do. We've been doing this -- this is our 70th year in business. So, you know, they kind of say shirtsleeves to shirtsleeves in three generations. We haven't gotten out of shirtsleeves yet, so we're okay.

So we hope to give you guys some knowledge. We hope to answer every question that we can possibly answer as truthfully and transparently as we can. We ask for you guys to listen with an open mind. And if you -- if you have some concerns, we'll try to address them. This is the time to do it.

So -- did you have a statement that we needed to -- let me get one of the white elephants out of the room. And just so we don't screw this up, I'm going to read this verbatim. So -- and then we can talk about it afterwards if you'd like.

But my brother Clint handled the sales at our business. And he has also been a lifelong employee of the company. He's been at the county for the last month. He has not been part of the day-to-day management, nor the plan and purchasing of this land for our company's growth. Because of the intentions of some to try and make this a perceived conflict, we asked my brother Clint to not be here tonight.

Let me state clearly, Maricopa County government has no authority to regulate this agricultural business. I assure you this is not a political dodge by my brother of the issues. The prohibition of the regulation of agriculture activities is not a county regulation, but state law. Arizona

Revised Statute 11-812(A)(2) does not allow political jurisdictions to prevent, restrict or otherwise regulate the use for occupation of land or improvements for railroad, mining, metallurgical or general agricultural purposes.

The other thing -- the second thing, and maybe Billy could like to address this so we can get this out of the way as well. You don't have your glasses, do you?

MR. BILLY HICKMAN: Do you want to continue?

MR. GLENN HICKMAN: Do you want to do that later?

MR. BILLY HICKMAN: I think so.

MR. GLENN HICKMAN: Okay. Anyway, so that we want to -- we want to address -- again, that's the elephant in the room. There is no conspiracy, there is no issue. My brother's been my brother his entire life. He's been a county supervisor for roughly nine months. But if there's a perceived conflict of interest, then we thought it would be best if he wasn't here. So I just want to kind of clear that to begin with.

MR. BILLY HICKMAN: Well, since we're -- since we're off the agenda anyway right out of the

gate, you know we might as well, if there's any general questions that --

MR. WIRTH: Billy, would you just explain, you know, the locations, the buildings, just so we kind of get some generalities. Just give them a basic rundown of how many buildings so they get a basic feel for it. And they can go --

MR. BILLY HICKMAN: Okay. So we bought the 360 acres from O&E Farms. And I first met with the two principal owners of O&E Farms in October at Tonopah Joe's. And just to give you the entire timeline, that was in October of 2013, just a few months ago.

The land deal closed in November of 2013. And that's when we put the sign up. And that location is on the 419th Avenue and Indian School, the half-mile mark. And, of course, it runs -- it runs south for one mile. And then there's a 40-acre piece -- 40-acre piece on the north side of the road.

We originally were looking at putting some pullet houses where we raise the baby chicks to the pullet stage, which gets moved into a lay house. But we have decided not to build over there. There's a couple reasons. So that land will stay farm ground on the north side of Indian School.

We are -- the 320-acre parcel that is on

the south side is a -- is going to be left as farm ground on the eastern half of it. The 160 acres that run from, you know, halfway, the half-mile mark to the west, a quarter mile, and that will be left as farm ground.

So the piece that we're talking about and I don't know if it's -- yeah, I don't know if -- if this is big enough for everybody to take a look at. But as you can see, this is the phase 1 that we've been talking about to everybody. And, of course, as I told the newspeople, that we always have high expectations of ourself in a growing market if we could continue growth.

But this is the piece that we're talking about currently. It would be on the northwest corner, or that corner right there.

These buildings contain a new type of enclosure, like I was trying to point in back. They have a nest box inside. They have a scratch pad. They have purchase. So that there's -- there's a -- there's more activity. There's -- there's less birds per enclosure. So that there's less density.

And I keep saying that, because the standards today is at 67 inches. And these are going at 116 inches. And that's per bird. The buildings are

about 560-foot long. They are about approximately 30-foot side wall, 82 feet across.

So -- and Paul Yeatts, who is our project coordinator, and he can correct me or come up here if I'm wrong. He's waving me off.

Anyway, so the processing plant is approximately 200 feet, 200 feet by 220. I might be wrong on that, because I'm just trying to go off memory. And that will have -- that will have two state-of-the-art egg graders that do everything. And at a later date, actually package the eggs and put them into the case, which I think is in one of the videos over, I think, behind -- behind Shari. It shows the robotics.

So that is -- that is the first phase. The processing plant and seven houses, per 2.2 million birds.

AUDIENCE SPEAKER: You are going to put that raw sewage on the farmland, right? The egg wash and the sewage, some of that is going to go directly without being treated on the farmland, right?

MR. BILLY HICKMAN: No. I think we already talked about this when I stopped in and talked to you. So --

AUDIENCE SPEAKER: Oh --

AUDIENCE SPEAKER: So what about Salome? There's an off-ramp and on-ramp on Salome. There's all kinds of property where nobody is even there.

MR. BILLY HICKMAN: Okay. I'm going to have to --

AUDIENCE SPEAKER: All manure stinks. And of all manure, chicken manure stinks the worst. And the reason is very simple. It has a high ammonia content which gives off nitrogen. And it can cause harm to human and animals. And 26.4 per cent of all nitrogen released in the atmosphere comes from chickens, from all forms and sources.

MR. WIRTH: You've got to have a question.

AUDIENCE SPEAKER: Why -- the question is, why are you bringing a stench factory in the middle of a residential neighborhood?

MR. BILLY HICKMAN: Okay. Let me answer that. Number one, I have been told by different people, leaders of the community, that's a commercial corridor. So when you're saying it's a residential, and I have been hearing from others that's a commercial corridor. So what I'm --

AUDIENCE SPEAKER: Do you live here? I can have --

MR. BILLY HICKMAN: Okay. Sir, can I ask -- can I answer some questions about -- you made a statement about -- you're probably using some old data. And I understand that, but that's okay.

AUDIENCE SPEAKER: It's data from 2012.

MR. BILLY HICKMAN: Okay. But when we feed chickens -- and you're saying nitrogen. But we feed on, instead of a pure protein level, we feed on an amino acid profile. So we don't put out -- we try very hard to sit there and lower the emissions, period.

So I'm not trying to -- that's just our -- that's just our way of feeding chickens. So I'm not saying that we don't put off an odor. I'm not going to say that I'm going to satisfy everybody. But we bought this property because of the proximity to I-10.

AUDIENCE SPEAKER: You didn't answer my question.

MR. BILLY HICKMAN: I'm sorry. What was your question?

AUDIENCE SPEAKER: Why would you put a stench factory in the middle of a residential neighborhood?

MR. BILLY HICKMAN: Because -- because this -- I'm sorry, this property was zoned agriculture.

AUDIENCE SPEAKER: I know that.

MR. BILLY HICKMAN: And we are --

AUDIENCE SPEAKER: Because you don't care how people care.

MR. BILLY HICKMAN: Okay. So we are putting -- we are putting an agricultural business on an agricultural-zoned property. That's the answer to your question.

AUDIENCE SPEAKER: That's not agriculture.

AUDIENCE SPEAKER: It stinks. Manure stinks.

MR. WIRTH: All right. Next question.

AUDIENCE SPEAKER: Hi. I have nothing against raising chickens. I'm sure everybody has on their farms. But I have a question -- okay. I live on 331st Avenue. We bought the property in '07. We smelled that chicken farm very rarely, and last year once in a while.

This year I'm getting that smell every day. No, I'm three miles approximately -- what am I -- north of you. And I -- I'm not trying to shut you down. Is there anything you can do about the odor, dust control, fly control, because I'm smelling it every day.

MR. BILLY HICKMAN: Okay.

AUDIENCE SPEAKER: And good neighbors do try to make good fences with good neighbors.

MR. BILLY HICKMAN: And I agree -- and I agree with that. And I don't want to sit there -- listen, we're being compared to the Arlington facility. And I understand that. And in my back pocket I wrote some notes.

And you're correct, ma'am, we started the project -- we started the project in Arlington in August of 1998. We sat there and developed practices to handle our waste streams, our chicken manure, and those kind of things that we continue to date. I agree that we're at fault. We've made a mistake.

We've been using the same practices as a company. And we have doubled to almost tripled the size of that facility with not changing our waste stream practices. So that's what you're saying is exactly true. And if you went back to 2'03, it would be even less.

As of -- I'm going to have to get a drink of water here in a minute.

MR. GLENN HICKMAN: Yeah, it's right there. Right there in the corner.

MR. BILLY HICKMAN: But anyway, as of

Those kind of things. So I wouldn't put my own children in harm's way.

AUDIENCE SPEAKER: Do you live there now?

MR. GLENN HICKMAN: No, I don't. We actually sold that farm on 91st Avenue to the City of Glendale.

AUDIENCE SPEAKER: My question to you is, I want to know that the kids that have to wait for buses in this air, who have asthma, and right now I can barely talk because of it. What is this air quality going to do to these children who are already with compromised immune systems? What's going to happen as they're waiting for the bus and the stench comes around?

MR. GLENN HICKMAN: And I can just answer is that the Maricopa County Air Quality Control regulates dust emissions. And they come out regularly and we're within tolerance.

AUDIENCE SPEAKER: Yeah, I have a question. I got a question. I retired down here. And I've got all my life savings built up in my house. And in doing that I have heard that the average price of a home in Arlington has dropped to around $31,000.

And you putting this plant here is -- and can you guarantee that you're not going to lower my

out there or transported daily?

MR. BILLY HICKMAN: Just transported daily.

AUDIENCE SPEAKER: Okay. What are they; minimum, medium, maximum?

MR. BILLY HICKMAN: You know, I would love for the guys at ACI to get a chance to tell you a little bit about their program.

AUDIENCE SPEAKER: Where is he at?

MR. BILLY HICKMAN: Glen or Mario, do you want to handle that?

AUDIENCE SPEAKER: Are you going to put inmates in your backyard with your kids?

MR. BILLY HICKMAN: Yes, actually, when the inmate program started, they were.

MR. DAVIS: Could you repeat the question, please.

AUDIENCE SPEAKER: Who is paying for the inmates to come back and forth?

MR. DAVIS: The question was, who pays for the inmates to go back and forth to be transported from the prison to Hickman's and then back to the prison. That's a cost of Hickman's.

AUDIENCE SPEAKER: Okay. What are they, what level are they?

MR. DAVIS: They're minimum security inmates. They're level 2s. And they go through a very stringent custody criteria to determine whether they're able to go outside of the institution or not. All of these inmates are ready to be released back out into the community, because their sentences are basically pretty well completed.

AUDIENCE SPEAKER: So they're minimum, right?

MR. DAVIS: They are minimum security.

AUDIENCE SPEAKER: What is level 2?

MR. DAVIS: Level 2 means minimum security. There's five levels in the Department of Corrections. Level 1; death row, admin segregation, those types of things. Level 2, maximum custody. So that means your central unit, they're really bad people.

Level 3 is a medium custody inmate. Level 2 is a medium -- or minimum custody inmate. Level 1 is an inmate that is out on a release status, inside of a halfway house or something like this. They're not incarcerated inside of an institution.

AUDIENCE SPEAKER: Is that --

MR. DAVIS: The inmates who work in one of these programs are 31.6 per cent less likely to

recidivate. If they don't recidivate and they don't go back to prison, you don't, as taxpayers, pay $54 a day for that person's incarceration.

AUDIENCE SPEAKER: They get paid.

AUDIENCE SPEAKER: They get paid while they're there. Why do they take a job from the citizen that needs a job when they're who's supporting them already anyway?

MR. DAVIS: We don't turn around and take jobs away from the community. The community has an access to go out there and get jobs.

AUDIENCE SPEAKER: But if they didn't have prisoners, there would be more people out to work.

MR. WIRTH: Anybody else want to ask a question?

MR. DAVIS: The inmates that are incarcerated that do work at these labor programs are required to turn around and pay court-ordered restitution. They are required to turn around and pay child support while they're incarcerated. They are required to turn around and have to pay room and board while they're incarcerated. The people that work out at Hickman's, they do have to pay for their medical expenses.

AUDIENCE SPEAKER: Do you get a reduction

AUDIENCE SPEAKER: But we don't want them in Tonopah.

MR. DIAZ: I understand that. But the same inmates that are working alongside the highway are the same inmates that are working for city and county, okay. So when we talk about the safety and the level of concern, we have staff that are supervising those inmates when they do come out. They don't just come out freely.

There are municipalities. So that you know, I'll give you an example. Let's talk about Gila Bend -- or not Gila Bend, let's talk about Casa Grande. We have inmates that work for the City of Casa Grande in their parks. We have them work inside of their golf courses.

And no, they are not classified as violent crimes. They cannot have a violent crime to work for ACI, or come out into the community. That's part of our classification system. They cannot be a sex offender. Okay. So everybody that comes out meets that criteria.

AUDIENCE SPEAKER: They --

MR. DIAZ: They may.

MR. WIRTH: Next question. We're going to move on. Here we go.

Arlington where they done -- they dealt with the fertilizer. Yes, people, that is going to stink.

Now, all you people that think that chickens aren't ground up and put in your pet food, think again. They can do that with those chickens. And with that I say thank you to Hickman's.

MR. BILLY HICKMAN: Thank you.

AUDIENCE SPEAKER: I have a concern about the flies and the mosquitoes. We don't have many mosquitoes out here, and not a lot of flies. But I'm really concerned about that.

MR. BILLY HICKMAN: Just on a bird health -- on a bird health issue, we are concerned about mosquitoes. We don't -- we don't have any standing water. You know, we sit there and make sure -- because that's how things are transmitted, is through mosquito bites, for both people and chickens.

That's how they get pox and that kind of thing. So we have a pretty -- we have a pretty in-depth management, pest control management. In fact, we have a licensed pest control operator on our staff that is full-time.

So as far as flies, one of the reasons we're switching to a different management system is because, you know, this -- these rains that we've had

that we have experienced a little difference, we have now realized we have to sit there and change our waste management streams.

We don't want flies. We get inspected by all the food companies. We get inspected by the retail chains. They need to have a safe food supply. And so they're -- you know, we get inspected or audited. And our compliance team is dealing with, you know, on-site inspectors on almost a monthly basis. It's a concern for us. And we make sure that we keep it in check and we try and succeed.

AUDIENCE SPEAKER: What about --

MR. BILLY HICKMAN: I'm sorry.

AUDIENCE SPEAKER: The flies --

MR. BILLY HICKMAN: I don't think you'll have more. You will let me know. We'll visit and you'll be able to tell me that. Okay.

AUDIENCE SPEAKER: I have three questions.

MR. BILLY HICKMAN: Mike, you didn't say that.

AUDIENCE SPEAKER: Yes, three questions, I've got three minutes.

MR. BILLY HICKMAN: You said Doris.

AUDIENCE SPEAKER: Okay. Number one, you

STATE OF ARIZONA)
) SS.
COUNTY OF MARICOPA)

BE IT KNOWN that the foregoing transcript was taken before me, SHERYL L. HENKE, a Certified Court Reporter in the State of Arizona; that the transcript of proceedings was taken down by me in shorthand and thereafter reduced to print under my direction; that the foregoing pages are a true and correct transcript of all proceedings, all done to the best of my skill and ability.

I further certify that I am in no way related to any of the parties hereto nor am I in any way interested in the outcome hereof.

Dated at Phoenix, Arizona, this 21st day of January, 2014.

Sheryl L. Henke

SHERYL L. HENKE - Digital Signature
AZ Certified Court Reporter No. 50745

it. Is there going to be a community if there is --

MR. BILLY HICKMAN: If there is going to be a --

AUDIENCE SPEAKER: Odor coming out of there.

MR. BILLY HICKMAN: You know, when you have any kind of animal agriculture, you are going to have an odor, okay. And I don't know if I can answer -- you want a yes, will there be an odor, or, no, there will be no odor. And I'm going to say I don't know, because we've never installed this kind of enclosure before in our history. All I can say is that there's a lot less chickens per square foot than there is currently.

AUDIENCE SPEAKER: We don't have --

MR. BILLY HICKMAN: I got it.

AUDIENCE SPEAKER: The question is, the land owner that you bought this land from, did he inform you that he was in trouble with the EPA two years ago? Because we had a bad smell coming over this area, including the park. He got himself in trouble with the EPA. The same sort of thing sounds like we may have again. Did he tell you about that?

MR. BILLY HICKMAN: No, I don't think there --

THE REPORTER: I can't hear.

AUDIENCE SPEAKER: We can't hear.

AUDIENCE SPEAKER: We have a natural hot springs here in Tonopah. And people come from all over the world to soak in these healing waters for pain relief, for relaxation, for quiet. Certainly not for flies and smells.

This is a family place. We have a lot of people here that this is where they live. It's kind of a bedroom community for the factory and for Palo Verde. And what kind of impact do you think that this is going to have on this clean water?

I see in some of the court stuff you folks have been through, it seems like you kind of get away with, like we didn't do it, because it was already dirty. Our water is clean. This water is clean right now. You're putting your factory into our clean water.

And I'm also very curious about how you intend to protect the Chiricahua leopard frog. It's an endangered indigenous species. I actually spoke with the conservation manager at the Phoenix Zoo this morning. They're going to look into it. And you may hear from them sometime in the near future. But we have a thriving wild population of an endangered indigenous species here in Tonopah. And I believe that

they are federally protected under the Environmental Protection Act. And that might be a little trouble, along with the people. So -- and this gentleman would also like to say something. But --

AUDIENCE SPEAKER: And we also have pictures of --

AUDIENCE SPEAKER: I'm a farmer. Put away your DDT.

AUDIENCE SPEAKER: Just real quick. Figure it out. You've probably never been to the hot springs right over here on the corner. But there is an oasis right over here on the corner. And it is pristine. I come down here from Montana just to soak in this water. When there is trucks going by, I ain't going to come. It's -- everybody's going to leave. Who is going to pay our bills down here for the hot springs when there ain't nobody?

AUDIENCE SPEAKER: Who is going to protect us if --

AUDIENCE SPEAKER: Don't spoil our economy. Is your business more important than theirs?

AUDIENCE SPEAKER: Okay. I have a question about the mortality rate of the chickens. On how often you change them out, and what you do with them when they're no longer useful.

MR. BILLY HICKMAN: Ma'am, I already answered that once before. I'm sorry. It is about 90 weeks, 90 to 110 weeks.

AUDIENCE SPEAKER: What about our hot springs?

AUDIENCE SPEAKER: Hi, my name is James Moon. I'm the owner of Tonopah Joe's. And I would like to ask you first the questions. Do you people know what Tonopah is? Can you tell me what the Tonopah name means?

MR. BILLY HICKMAN: What does Tonopah mean?

AUDIENCE SPEAKER: Do you know how I know about Tonopah? I read the newspaper 2007. Tonopah means hot waters growing in the town, in the bush. And one of -- one of ASU professors predicted Tonopah would be another Scottsdale resort in 10, 15 years.

I emigrated from Korea when I was 26. I was a real poor, poor boy when I was young, nine years old. I sold (indiscernible) door to door. And then I heard there is a great American dream happening, United States. When I was young, I worked so hard and I had the great American dream.

I came here 1975. I went to ASU. I study hard. I work two jobs. I work 18 hours a day.

I slept on the -- okay. I'm going to have a good question. I slept -- I slept 30 seconds after work, after school. Why the red light. That's how my life 40 years in America.

And after I read the article, I decided to pour everything in Tonopah, because I had American dream. Not just to be rich. But I have big dreams of poor people who want to study like me. I couldn't go to college in Korea, because I didn't have a penny. I had $30 in my pocket and came here to be in American country.

AUDIENCE SPEAKER: He's trying to say you're ruining his business.

AUDIENCE SPEAKER: Okay. Let me ask you a real question. You're the ones with clout. I heard you are richest people -- one of the richest people in Arizona. We have -- I run the restaurant. I have so many friends here. They come to my restaurant. They tell me this is the peaceful, most paradise in the world. That's why they move out of city and they got the homes in here.

Are you -- the money is more vital than thousands of people in Tonopah, people's life? Tell me about that.

MR. BILLY HICKMAN: We plan on keeping it

safe, sir.

AUDIENCE SPEAKER: How much do you want?

MR. BILLY HICKMAN: What I'm saying -- what I think -- I understand -- I understand the importance of your business and your livelihood. It's the same thing with us. And we take our customers, we take our customers very seriously. We take their requests to supply very seriously just like you do.

We have to -- we want to be a safe -- we want to be a safe business also. We don't want to be a negative impact to your business. I understand that. That's our entire -- that's our entire reason for being here and trying to explain how we do things differently.

So I don't know if I can answer your question, because you're saying that you're concerned about our business ruining your business. And I have no intention. I'm hoping that we enhance your business. That there is more activity out here.

AUDIENCE SPEAKER: Do you have any studies on what you're going to do to the environment in the future; the water table, the quality of the water? Because we get ours tested every month. And if there's a problem, we're coming to see you.

MR. BILLY HICKMAN: I keep hearing that

EXHIBIT 7

Analysis of Air Emission from the Hickman Farms Egg Facility in Tonopah Arizona by Mikhail Chester, Ph.D. (June 4, 2014)

ANALYSIS OF AIR EMISSIONS FROM THE HICKMAN FARMS EGG FACILITY IN TONOPAH, ARIZONA

Prepared by Mikhail V. Chester, Ph.D.

Prepared for The Shanker Law Firm, PLC

4 June 2014 Preliminary Report

Table of Contents

1 Objective

The objective of this report is to document the findings of an air emissions study developed for three production scenarios at the Hickman Farms Egg Facility currently in its final stages of construction in Tonopah, Arizona. Estimates of the conventional air pollutant (PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, and NMHC) emissions associated with current (pre egg facility) traffic are compared against the air emissions that may occur due to new light and heavy duty vehicle traffic associated with facility operations.

2 Site Description

The area of interest is the section of W. Indian School Road between 419th Avenue and 411th Avenue, in Tonopah, Arizona, approximately one mile in length. As such, the study analyzes vehicle travel in the one mile site.

Figure 1: Study Site with Roadways of Interest Shaded in Red (Source: Google Maps)

3 Traffic Analysis

A traffic analysis is developed to estimate i) the current traffic volumes in the study site and ii) the new traffic generated from the egg facility. These traffic estimates are the foundation of the air emissions assessment.

3.1 Current Traffic

Current traffic volumes in the study site are estimated from the Maricopa County Department of Transportation (MCDOT) and Arizona Department of Transportation (ADOT) traffic counts. Average annual daily traffic (ADT) from 2006 to 2013 obtained from MCDOT and ADOT traffic counts on Indian School Road are used in the study. MCDOT counted 368 vehicles east to 411th Avenue and 469 vehicles west to 411th Avenue in 2013 [1]. ADOT's Transportation Data Management System reports an ADT on Indian School Road of 408 (Local ID 3414) in 2006 [2]. Historical MCDOT traffic counts between 2009 and 2012 range from 391 to 479 for the study site [3]. An average ADT from 2009 to 2013 on Indian School Road west to 411th Avenue is estimated at 450 vehicles and is used as the current (background) traffic volume.

The 450 vehicle background traffic volume is disaggregated into light and heavy duty vehicles. MCDOT's Roadway Management System reports that for arterial and collector classification roadways 4.43% of vehicles in 2010 and 8.42% of vehicles in 2006 were heavy duty. As such, 5% of the 450 vehicles through the study site are estimated to be heavy duty classification. A split of 50% light duty automobiles (e.g., sedans) and 50% light duty trucks (e.g., SUVs and pickups) is used given the rural/agricultural land use in the region. Table 1 reports the estimated annual daily traffic by vehicle type.

Table 1: Annual Daily Traffic in Study Site by Vehicle Type.

Vehicle Type	Annual Daily Traffic
Light Duty Automobile	214
Light Duty Truck	214
Heavy Duty Vehicle	23
Total	450

3.2 Scenarios for New Traffic

Four scenarios are evaluated including a do nothing (i.e., current/baseline traffic) and three levels of production at the Egg Facility. The three levels of production include 2.2 million birds (Scenario 1), 8 million birds (Scenario 2), and 12 million birds (Scenario 3).

The relevant input parameters for each scenario are summarized in Table 2. Calculation details are described after the table.

Table 2: Estimation of Traffic Resulting from Egg Facility in Production Scenarios

Detail	Scenario 1	Scenario 2	Scenario 3
# of Birds	2.2 million	8 million	12 million
	Manure		
Weight (lbs/day)	330,000	1,200,000	1,800,000
Volume (trucks/day)	6.6	24	36
FHWA Classification	Type 9	Type 9	Type 9
	Dead Chickens		
Weight (lbs/year)	3,441,429	12,514,286	18,771,429
Volume (trucks/year)	69	250	375
FHWA Classification	Type 9	Type 9	Type 9
	Feed		
Weight (lbs/day)	350,000	1,266,864	1,900,000
Volume (trucks/day)	7	25	38
FHWA Classification	Type 9	Type 9	Type 9
	Eggs		
Volume (trucks/day)	3.5	12.7	19
FHWA Classification	Type 8	Type 8	Type 8
	Additional Daily Vehicles		
FHWA Class 9	13.8	50.0	75.0
FHWA Class 8	3.5	12.7	19
Bus	1	1	1
Passenger Cars	22	80	120

Manure:

The Midwest Plan Service MWPS-18, 2nd Edition (2005) Manure Characteristics reference (Table 6, Page 13) estimates that an egg layer with an average weight of 3 pounds produces 0.15 pounds of manure per day.

$$Total\ Manure\ Weight\ (lbs) = Number\ of\ Birds \times 0.15$$

Assuming that the facility will be sending this manure to lands in the Southeast Valley using the fewest trucks possible requires a gross vehicle weight of 80,000 lbs (largest legal GVW in AZ). This weight would require a Federal Highway Administration Class 9 truck which has an approximate haul weight of 50,000 lbs per load.

$$Number\ of\ Manure\ Trucks\ (trucks\ per\ day) = \frac{Total\ Manure\ Weight\ (lbs)}{50{,}000\ (lbs)}$$

Dead Chickens:

Keeping the same average weight of 3 lbs for each chicken and assuming an average dead loss turnover of 100 weeks (Hickman's estimate is 90 – 110 weeks). Assume the same scenario as with manure and a per-load weight of 50,000 lbs produces the following number of averaged daily trucks. Note that for the pavement analysis an annualized average daily truck traffic follows convention, but this may not be applicable for analysis of other factors.

$$\textit{Number of Dead Chicken Trucks (trucks per 100 weeks)} = \frac{3\ (lbs) \times \textit{Number of Birds}}{50{,}000\ (lbs)}$$

$$\textit{Number of Dead Chicken Trucks (trucks per year)} = \frac{3\ (lbs) \times \textit{Number of Birds}}{50{,}000\ (lbs)} \times \frac{365\ (days\ per\ year) / 7\ (days\ per\ week)}{100\ (weeks\ per\ cycle)}$$

$$\textit{Number of Dead Chicken Trucks (trucks per day)} = \frac{\textit{Number of Dead Chicken Trucks (trucks per year)}}{365}$$

Feed and Eggs:

Hickman's estimate (in a transcript from Community Information Meeting, January 9, 2014) for the number of trucks is 1 truck per day per CAFO for feed and 0.5 truck per day per CAFO for eggs. Feed is assumed to arrive in a fully loaded FHWA class 9 truck whereas eggs are assumed to leave on a FHWA class 8 truck.

Additional Daily Vehicles:

One additional bus (to transport inmates to and from the facility) is projected in all three scenarios. Employee related passenger car vehicles are also included.

4 Air Emissions from Vehicles

Conventional air pollutant emissions from light and heavy duty vehicle travel currently and in the three scenarios of Egg Facility production are estimated. Conventional air pollutants are either directly or precursor to the Criteria air pollutants, those regulated by the 1970 Clean Air Act and 1990 Amendments. A description of the pollutants assessed as reported by the U.S. Environmental Protection Agency are:

- Particulate Matter with a diameter of 10 Microns or less (PM_{10}): "Particulate matter, also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. The size of particles is directly linked to their potential for causing health problems. EPA is concerned about particles that are 10 micrometers in diameter or smaller because those are

the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects." [4]

- Particulate Matter with a diameter of 2.5 Microns or less ($PM_{2.5}$): "Fine particles, such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller. These particles can be directly emitted from sources such as forest fires, or they can form when gases emitted from power plants, industries and automobiles react in the air." [4]
- Nitrogen Oxides (NOx): "Nitrogen dioxide (NO_2) is one of a group of highly reactive gasses known as *oxides of nitrogen*, or *NOx*. EPA's National Ambient Air Quality Standard uses NO_2 as the indicator for the larger group of nitrogen oxides. NO_2 forms quickly from emissions from cars, trucks and buses, power plants, and off-road equipment. In addition to contributing to the formation of ground-level ozone, and fine particle pollution, NO_2 is linked with a number of adverse effects on the respiratory system." [4]
- Sulfur Dioxide(SO_2): "Sulfur dioxide is one of a group of highly reactive gasses known as *oxides of sulfur*. SO_2 is linked with a number of adverse effects on the respiratory system." [4]
- Carbon Monoxide (CO): "CO is a colorless, odorless gas emitted from combustion processes. Nationally and, particularly in urban areas, the majority of CO emissions to ambient air come from mobile sources. CO can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues. At extremely high levels, CO can cause death." [4]
- Non-Methane Hydrocarbons (NMHC): NMHC are volatile organic compounds, excluding methane, a greenhouse gas. "VOCs are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects." [5]

For light duty automobile, light duty truck, and heavy duty vehicles, emission factors are estimated using the state-of-the-art U.S. Environmental Protection Agency's Motor Vehicle Emissions Simulator (MOVES). These factors are joined with the previously described traffic volumes to estimate study site emissions.

4.1 Emission Factors for Vehicles

The U.S. Environmental Protection Agency's MOVES model is used to estimate emission factors for vehicle movement in Maricopa county. MOVES is the preferred model for estimating emissions for state implementation plans, for compliance for the Clean Air Act and Amendments. MOVES has a county-specific option which populates model inputs with region-specific fleet, fuel, and meteorological data. MOVES assesses many different vehicle and fuel combinations and representative MOVES vehicles are selected for the relevant vehicles in this study. The vehicle mapping and emissions are reported in Table 3.

Table 3: Vehicle Emission Factors per Mile of Travel

Study Vehicle	MOVES	PM10 (mg)	PM2.5 (mg)	NOx (g)	SO2 (mg)	CO (g)	NMHC (mg)
Light Duty Automobile	Passenger Car (Gasoline)	6	6	0.4	5	2.8	157
Light Duty Truck	Passenger Truck (Gasoline)	11	11	1.1	6	6.7	431
Bus	School Bus (Diesel)	321	310	5.7	8	5.1	478
Heavy Duty Truck	Combo Long-haul Truck (Diesel)	472	458	11.4	17	3.3	796

Heavy duty vehicle emissions will change significantly when the truck is carrying cargo versus empty, and emissions reduction estimates are developed based on loaded and unloaded vehicle weight ratings. Using output from the MOVES model at varying heavy duty vehicle weights [6], reduction factors for each pollutant are estimated for unloaded operation. These unloaded heavy duty vehicle emission reduction percentages are reported in Table 4.

Table 4: Unloaded Heavy Duty Vehicle Emissions Reduction Percentage

	PM10	PM2.5	NOx	SO2	CO	NHMC
Heavy Duty Truck Class 9	36%	36%	33%	37%	46%	70%
Heavy Duty Truck Class 8	40%	40%	37%	40%	50%	73%

4.2 Scenario Emissions

The results for the current/baseline scenario and the three production level scenarios are shown in Table 5. Note that Scenarios 1-3 are in addition to the current 450 vehicles per day that travel through the study site.

Table 5: Estimated Current and Egg Facility Emissions in Kilograms per Year

	PM10	PM2.5	NOx	SO2	CO	NMHC
Current	4.6	4.4	180	1.0	760	49
Current+Scenario 1	8.4	8.1	270	1.2	760	59
Current+Scenario 2	18	17	480	1.8	1,100	83
Current+Scenario 3	24	24	630	2.2	1,300	100

The Scenario 1-3 emissions are dominated by particular processes related to the egg facility. PM_{10}, $PM_{2.5}$, and NOx are dominated by truck for manure and feed. SO_2, CO, and NMHC emissions are significantly impacted by the additional light duty vehicle traffic from employees accessing and egressing the Egg Facility. For all pollutants across all scenarios, the manure and egg heavy duty vehicle traffic contributes a majority share.

5 Findings

The light and heavy duty vehicle traffic that result from the Egg Facility will very likely result in significant quantity of new air emissions at the study site. Even at the lowest production level (2.2 million chickens in Scenario 1) the study site experiences 82% increases in PM emissions and a 48%

increase in NOx emissions. In Scenario 2 (a reasonable ramp up to 8 million chickens), the study site experiences a 286% more PM emissions, near 167% more NOx emissions, and 84% and 69% increases in SO_2 and NMHC emissions. Scenario 3 results in even larger increases in all pollutants as reported in Table 5.

There are several factors not included in the assessment. The analysis does not consider emissions from vehicle idling at the Egg Facility. It also does not consider the background pollutant concentrations in the region and how increases in these pollutants from Egg Facility traffic may lead to increased exposure by the nearby population and the associated public health impacts. Furthermore, emissions from the facility itself such as those from activities or onsite equipment *(e.g., generators or machinery) are not considered.*

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BASIC INFORMATION

ACADEMIC EXPERIENCE

- Assistant Professor (2011 to present)
  Civil, Environmental, and Sustainable Engineering
  Affiliate Faculty, School of Sustainability
  Arizona State University
- Lawrence Berkeley National Laboratory (2010 to 2011)
  International Energy Studies Group
- Post-doctoral Researcher (2008 to 2011)
  Civil and Environmental Engineering
  University of California, Berkeley

EDUCATION

- Ph.D. – University of California, Berkeley (August 2008)
  Civil and Environmental Engineering
- M.S. – University of California, Berkeley (May 2005)
  Civil and Environmental Engineering (Systems Engineering Program)
- M.S. – Carnegie Mellon University (May 2003)
  Civil and Environmental Engineering (Systems Engineering Program)
- B.S. – Carnegie Mellon University (May 2002)
  Double Major in Civil and Environmental Engineering
  & Engineering and Public Policy

HONORS AND AWARDS

- Selected for the National Academy of Engineering's Frontiers of Engineering Education workshop in Irvine, CA in October 2013.
- Teaching Award from the School of Sustainable Engineering and the Built Environment at Arizona State University for 2013.
- Testified to the California Legislative Analyst's Office on the environmental impacts of high-speed rail in April 2012.
- Participated (as a researcher and chapter author) on the National Research Council's Committee on Health, Environmental, and Other External Costs and Benefits of Energy Production and Consumption in the preparation of the *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use* 2010 report.
- *Environmental Assessment of Passenger Transportation Should Include Infrastructure and Supply Chains* publication selected to Environmental Research Letter's 2011 5th Anniversary Collection as one of the top 3 articles of 2009.
- Outstanding Graduate Student Instructor awarded by the University of California, Berkeley's Graduate Council for the 2006-2007 academic year.
- Participant in the Carnegie Mellon University's Engineering and Public Policy course project *Voting System Transitions: What are the Options for Pennsylvania?* which received the Stephen Omer Lee Award as the outstanding project course in 2001.
- Participant in the Carnegie Mellon University's Engineering and Public Policy course project *Environmental Impacts of E-commerce - A Case Study of Book Purchasing* which received the Stephen Omer Lee Award as the outstanding project course in 2000.

RESEARCH ACTIVITIES

PUBLICATONS

REFEREED JOURNAL PUBLICATIONS

1) Pincetl S, Chester M, Circella G, Sivaraman D, Murphy S, Reyna J, and Fraser M (2014) Enabling Future Sustainability Transitions: An Urban Metabolism Approach to Los Angeles. *Journal of Industrial Ecology*, Forthcoming.
2) Bartos M and Chester M (2014) The Conservation Nexus: Valuing the Interdependent Water and Energy Savings in Arizona. *Environmental Science & Technology*, 48(4), pp 2139-2149, doi: 10.1021/es4033343.
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8) Chester M, Pincetl S, Elizabeth Z, Eisenstein W, and Matute J (2013) Infrastructure and Automobile Shifts: Positioning Transit to Reduce Life-cycle Environmental Impacts for Urban Sustainability Goals. *Environmental Research Letters (Focus Issue on Environmental Assessments and the Built Environment)*, 8(1), doi: 10.1088/1748-9326/8/1/015041.
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12) Michalek J, Chester M, and Samaras C (2012) Getting the Most Out of Electric Vehicle Subsidies. *Issues in Science and Technology*, Summer 2012, 25-27.
13) Chester M and Horvath A (2012) High-speed Rail with Emerging Automobiles and Aircraft to Reduce Environmental Impacts in California's Future. *Environmental Research Letters*, 7(3), doi: 10.1088/1748-9326/7/3/034012.
14) Sathre R, Chester M, Cain J, and Masanet E (2012) A Framework for Environmental Assessment of Carbon Capture and Storage Systems. *Energy*, 37(1), 540-548, doi:10.1016/j.energy.2011.10.050.
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- Nahlik M and Chester M. *Assessing the Potential of Transit-Oriented Development Infill to Reduce Life-Cycle Energy-Use and Environmental Impacts: A Case Study of Los Angeles Metro's Gold and Orange Transit Lines*, In review at Transport Policy.
- Pincetl S, Chester M, Circella G, Sivaraman D, Murphy S, Reyna J, and Fraser M, *Positioning Urban Metabolism to Enable Future Transitions: A Spatially-explicit Integrated Infrastructure, Economic, & Behavior Assessment of Los Angeles*, In review at the Journal of Industrial Ecology.

Articles in Preparation

- Sekar A, Williams E, and Chester M, *Siting is a Major Constraint to Realize Net Environmental Benefits from Carbon Capture and Storage.*
- Kimball M and Chester M, *Breaking Automobile Path Dependence: Life Cycle Assessment for Reducing Economic and Environmental Costs in Phoenix, Arizona.*
- Fraser A and Chester M. *Exploring the Relationship between Infrastructure Saturation and Peak Travel with Environmental Life Cycle Assessment.*
- Reyna J and Chester M. *The Growth of Urban Building Infrastructure, and its Unintended Lock-in and Embedded Environmental Effects.*
- Sivaraman D, Chester M, and Pincetl S. *State-level Strategies for Renewable Portfolio Standards: Reducing CO_2 Emissions and Air Quality Impacts.*

BOOK CHAPTERS

- White P and Chester M. Framework of Life Cycle Assessment in *Environmental Life Cycle Assessment*, American Center for Life Cycle Assessment, In Press.
- Chester M, Ryerson M, and Horvath A. Forecasting and Life Cycle Assessment for High-speed Rail Energy and Environmental Assessment in *High Speed Rail and Sustainability*, Routledge, In Press.
- Chester M (2010) Development of Life Cycle Energy Use and Emissions of Vehicle Technologies and Fuels appendix in the National Research Council's Committee on Health, Environmental, and Other External Costs and Benefits of Energy Production

and Consumption *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use*, National Academies of Sciences.

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- Chester M, Horvath A, and Madanat S (2011) Parking Infrastructure and the Environment, *University of California Transportation Center's Access Magazine.*
- Chester M and Horvath A (2010) Life-cycle Environmental Assessment of California High Speed Rail, *University of California Transportation Center's Access Magazine.*

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- Eisenstein W, Chester M, and Pincetl S (2013) Policy Options for Incorporating Life-Cycle Emissions Assessment into Transportation Planning. *Proceedings of the Transportation Research Board 92nd Annual Meeting.*
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- Matute J and Chester M (2014) *Cost-Effectiveness of Reductions in Greenhouse Gas Emissions from California High-Speed Rail and Urban Transportation Projects*, University of California, Los Angeles Institute of Transportation Studies, http://goo.gl/ck03jp.
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- Ferrell J and Chester M (2012) *Life Cycle Assessment of Ecosystem Services for Phoenix's Building Stock*, Arizona State University Report No. SSEBE-CESEM-2012-RPR-001.
- Ferrell J, Spierre S, and Chester M (2012) *Urban Metabolism and the Energy-Water Nexus in Phoenix, Arizona*, Arizona State University Report No. SSEBE-CESEM-2012-CPR-012.

- Horvath A and Chester M (2011) *Life Cycle Assessment Support for California EPA's Green Chemistry Initiative*, California Environmental Protection Agency.
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- Chester M (2008) *Life-cycle Environmental Inventory of Passenger Transportation Modes in the United States*, University of California, Berkeley, Doctoral Dissertation.

POPULAR PRESS

- NPR (2013), Studying Who Heat Islands Hurt and Where They Live, http://goo.gl/RNi11l
- The Guardian (2013), Is It Greener to Travel by Rail or Car?, http://goo.gl/dBWNMb
- Environmental Research Web (2012), High-speed Rail Could Benefit California, http://goo.gl/RnUYb
- KPBS (2012), Study Suggests Environmental Benefits From California High Speed Rail, http://goo.gl/eOOqP
- Phys Org (2012), Future of Major High-speed Rail Project Looks Green, http://goo.gl/7VxWL
- KQED (2012), Study Says High Speed Rail Could Lower State's Carbon Footprint, http://goo.gl/0FMGN
- Bloomberg (2011), U.S. Battery, Plug-in Car Push Costs Exceed Rewards, http://goo.gl/mLBYh
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- Environmental Research Web (2010), How do Parking Lots Affect the Environment? http://goo.gl/DQd1n
- San Francisco Business Times (2010), Looking for a Parking Space? Ask Heisenberg, http://goo.gl/M0mfe
- Environmental Research Web (2010), Will the Train Take the Strain? http://goo.gl/zOBzZ
- New York Times (2009), How Green is Rail Travel? http://goo.gl/csj3r
- BBC (2009), Fuel Emissions Focus 'Too Narrow', http://goo.gl/7jZuB
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- NPR (2008), Ethanol Worse for Climate than Gasoline, http://goo.gl/0l9b4
- San Francisco Chronicle (2008), Better Biofuels Before More Biofuels, http://goo.gl/rVFxt

PRESENTATIONS

SPEAKING INVITATIONS

- *Energy and Environmental Assessment of Urban Infrastructure Systems for Sustainability Strategies* (Upcoming in March 2014) NSF US-Israel workshop hosted by Stanford University and Lawrence Technological University (Tel Aviv, Israel).
- *Infrastructure Investments and Management for a Climate-constrained Future* (2013) Monash University (Melbourne, Australia).
- *Human-Carbon Interactions in Urban Systems* (2013) National Center for Atmospheric Research (Boulder, CO).
- *Infrastructure Investments and Management for a Climate-constrained Future* (2013) International Road Federation Webinar.
- *Urban Infrastructure Investments and Environmental Life-cycle Impacts* (2013) California Air Resources Board (Sacramento, CA).
- *Energy and Environmental Life Cycle Assessment of Passenger Transportation* (2013) University of California, Los Angeles' Institute of the Environment and Sustainability, Lunchtime Seminar (Los Angeles, CA).

- *High-speed Rail with Emerging Automobiles and Aircraft Can Reduce Environmental Impacts in Future Long-distance Transportation* (2012) University of California, Berkeley's High-speed Rail Workshop (Berkeley, CA).
- *Energy and Environmental Assessment of Urban Infrastructure Systems for Sustainability Strategies* (2012) University of Michigan's School of Natural Resources and the Environment (Ann Arbor, MI).
- *Strategies for Integrating Life-cycle Assessment with Sustainable Transportation Policy* (2012) National Science Foundation's Research Coordination Network on Sustainable Cities (Estes Park, CO).
- *High-speed Rail with Emerging Automobiles and Aircraft Can Reduce Environmental Impacts in Future Long-distance Transportation* (2012) Transportation Research Board's Airport Cooperative Research Program's National Aviation Systems Planning Symposium (Galveston, TX).
- *Life Cycle Energy and Environmental Effects: The Case of Los Angeles Metro* (2011) Intelligent Transportation Systems of America's Sustainable Transportation Working Group Meeting (Webinar).
- *Public Transit Sustainability in Transportation and Land Use Policy* (2011) California Energy Commission (Sacramento, CA).
- *Environmental Tradeoffs in Transportation Infrastructure Investment* (2011) University of California, Los Angeles' Transportation and Land Use Conference (Arrowhead, CA).
- *Evolving Research Goals from a Short Transportation Life Cycle Assessment Career* (2011) Carnegie Mellon University's Civil and Environmental Engineering Department's Friday Seminar (Pittsburgh, PA).
- *Life Cycle Impacts of Plug-in Vehicles: Cost Trade-offs of Conventional and Electric Vehicles?* (2011) Stanford University's Electric Mobility Workshop (Stanford, CA).
- *Life Cycle Assessment of High-speed Rail: Comprehensive Environmental Accounting* (2011) University of California, Berkeley's Center for Environmental Public Policy High-speed Rail Conference (Berkeley, CA).

CONFERENCE AND SESSION ORGANIZING

- Technical Committee member for the 2014 International Symposium on Sustainable Systems and Technology (Oakland, CA).
- Session organizer for the NSF Sustainable Cities Research Collaboration Network at the 2014 ASCE International Conference on Sustainable Infrastructure (Long Beach, CA).
- Technical Committee member for the 2013 International Symposium on Sustainable Systems and Technology (Cincinnati, OH).
- Organized the *Life Cycle Environmental Assessment and Public Policy* session (2013) International Symposium on Sustainable Systems and Technology (Cincinnati, OH).
- Co-organized the *Urban Metabolism: Theory and Practice* session (2013) American Association of Geographers (Los Angeles, CA).
- Co-organized with the United Nations Environment Programme (2013) the *Systems-oriented Assessment for Urban Sustainability* session, LCA XII (Tacoma, WA).
- Technical Committee member for the 2011 International Society of Industrial Ecology's conference (Berkeley, CA).

OTHER NOTABLE PRESENTATIONS

- Air Quality Benefits of Smart Growth (2014) EPA Workshop Reconciling Air Quality Planning to Promote Sustainable Development at the Transportation Research Board's 2014 Annual Meeting (Washington, DC).
- The Conservation Nexus: Valuing Interdependent Water and Energy Savings in Phoenix, Arizona (2013) American Geophysical Union (San Francisco, CA).
- Integrated Transportation and Land Use Life Cycle Assessment Time-based Greenhouse Gas Impacts (2013) International Symposium on Sustainable Systems and Technology (Cincinnati, OH).

- Urban Metabolism and Life Cycle Assessment (2013) American Association of Geographers (Los Angeles, CA).
- Energy and Environmental Life Cycle Assessment (2013) Southern California Association of Governments (Los Angeles, CA).
- Energy and Environmental Life Cycle Assessment (2013) Los Angeles Metro (Los Angeles, CA).
- Transportation and Land-use Life-cycle Energy and Environmental Co-benefits (2013) Arizona State University's School of Geographical Sciences and Urban Planning (Tempe, AZ).
- Life Cycle Assessment for Transportation Decision Making (2013) Transportation Research Board's Transportation Programming, Planning, and Systems Evaluation Committee (Washington, DC).
- Current Research and Future Challenges in Assessing Greenhouse Gas Emissions from Air and High-speed Rail Corridors: Spatial Incompatibility, Competition, and Complementarity (2013) Transportation Research Board's Aviation Climate Subcommittee (Washington, DC).
- Current Research and Future Challenges in Assessing Greenhouse Gas Emissions from Air and High-speed Rail Corridors: Spatial Incompatibility, Competition, and Complementarity (2013) Transportation Research Board's Aviation and the Environment Subcommittee (Washington, DC).
- Life-cycle Impacts of Plug-in Vehicles: Cost Trade-offs of Conventional and Electric Vehicles (2012) Society for Risk Analysis (San Francisco, CA).
- Life-cycle Impacts of Plug-in Vehicles: Cost Trade-offs of Conventional and Electric Vehicles (2012) Society for Environmental Toxicology and Chemistry (Long Beach, CA).
- TOD Infill in Phoenix Can Reduce Future Transportation and Land Use Life-cycle Environmental Impacts (2012) Phoenix's Sustainable Communities Collaborative (Tempe, AZ).
- Strategies for Integrating Life Cycle Assessment with Urban Sustainability Transportation Policy (2012) International Symposium on Sustainable Systems and Technology (Boston, MA).
- Advancing Transportation Environmental Planning with Life-cycle Assessment (2012) University of San Francisco's Urban Planning Program (San Francisco, CA).
- Advancing Transportation Environmental Planning with Life-cycle Assessment (2012) American Planning Association (Los Angeles, CA).
- Life Cycle Assessment and Precautionary Purchasing (2012) International Conference on Sustainability Science (Tempe, AZ).
- Environmental Tradeoffs in Transportation Infrastructure Investment (2011) LCA XI (Chicago, IL).
- Environmental Tradeoffs in Transportation Infrastructure Investment (2011) San Francisco Municipal Transportation Authority (San Francisco, CA).
- Life-cycle Impacts of Plug-in Vehicles: Cost Trade-offs of Conventional and Electric Vehicles? (2011) Stanford University's Electric Mobility Workshop (Stanford, CA).
- Life-cycle Assessment of High-speed Rail: Comprehensive Environmental Accounting (2011) University of California, Berkeley's Center for the Environment and Public Policy's High Speed Rail Workshop (Berkeley, CA).

RESEARCH PROPOSALS

FUNDED PROJECTS AS PRINCIPAL INVESTIGATOR

- Chester M (1/2014-12/2014) *Advancing Knowledge of Urban Infrastructure Growth and the Sustainable City. Google Research Foundation.* $64,000.
- Chester M (9/2013-8/2016) Collaborative Research: Prioritizing Cooling Infrastructure Investments for Vulnerable Southwest Populations. *National Science Foundation. PI for $460,000 project: $160,000 to Chester, $140,000 to Co-PI*

Eisenman (UCLA School of Medicine), $140,000 to Co-PI Pincetl (UCLA Institute of the Environment and Sustainability).

- Chester M (9/2013-8/2016) Positioning Engineers for Urban Sustainability Transition Strategy Development. *National Science Foundation.* PI for $200,000 project. Co-PI Parrish.
- Chester M (5/2013-8/2013) Life-cycle Impact Assessment of Embedded Water in Phoenix-area Building Materials. *National Science Foundation's Central Arizona-Phoenix Long-Term Ecological Research.* Summer research support of $4,000 for graduate student Janet Reyna.
- Chester M (1/2013-8/2013) California Used Oil Infrastructure Futures Life Cycle Assessment. *California Environmental Protection Agency (Subcontract through the University of California, Santa Barbara).* $20,000.
- Chester M (5/2012-8/2012) Water-Energy Nexus Assessment and Phoenix Building Embedded Effects. *National Science Foundation's Central Arizona-Phoenix Long-Term Ecological Research.* $7,000.
- Chester M (PI) and Ryerson M (Co-PI, University of Tennessee, Knoxville) (5/2012-12/2012) Synthesis of Air and High-speed Rail Environmental Assessment Frameworks in the US. *Transportation Research Board's Airport Cooperative Research Program.* $40,000 ($17,000 subcontract to the University of Tennessee, Knoxville).
- Chester M (12/2011-10/2014) Energy and Greenhouse Gas Life Cycle Assessment of Transportation and Buildings in Los Angeles. *California Energy Commission (Subcontract through the University of California, Los Angeles).* $65,000.

FUNDED PROJECTS AS CO-PRINCIPAL INVESTIGATOR

- Landis A (PI), Seager T, Chester M, and Parrish K. TUES: Integrating Sustainability Grand Challenges and Experiential Learning into Engineering Curricula. *National Science Foundation.* $385,000 project total: $10,000 to Chester.
- Seager T (PI), Chester M. Training Next Generation Faculty and Students to Address the Infrastructure Crisis. *National Science Foundation.* $30,000 to Arizona State University Team: $10,000 to Chester.

PROPOSALS UNDER REVIEW

- Chester M (PI), Harlan S (Co-PI, ASU), Davis R (Co-PI, UVA), Knight D (Co-PI, VT), and Vanos J (Co-PI, Texas Tech). Individual Thermal Exposure Monitoring for Smart Heat Health Intervention Strategies. *National Science Foundation.* $1.9 million to team; $750,000 to Arizona State University.
- Chester M (PI) and Scown C (Co-PI, Lawrence Berkeley National Laboratory). A systems-level approach for strategic scale-up of biofuels in water-stressed regions. *US Department of Agriculture Sustainable Bioenergy Program.* $300,000 ($160,000 to Chester).
- Gurney K (PI), Chester M (Co-PI), and Pincetl S (Co-PI). Urban Greenhouse Gas mitigation decision support system: linking atmospheric monitoring to mitigation policy options in the Los Angeles megacity. *NASA.* $1 million to team: $240,000 to Chester.
- Chester M (PI), Ruddel B (Co-PI), Seager T (Co-PI), and Miller C (Co-PI). Advancing Infrastructure and Institutional Resilience to Climate Change for Coupled Water-Energy Systems. *National Science Foundation.* $600,000 to Arizona State University Team.

STUDENT RESEARCH FELLOWSHIPS

- Nahlik M (8/2013-5/2014) *Estimating the Costs and Benefits of Transit Oriented Developments.* Dwight David Eisenhower Graduate Fellowship Program: $6,500.
- Bartos M (5/2013-8/2013) *Evaluating the Water-Energy Conservation Nexus in Arizona.* Grant through the National Science Foundation's Central Arizona-Phoenix Long-term Ecological Research Program: $4,000.
- Reyna J (6/2013-5/2016) *Coupled Socio-Technical Drivers for Urban Energy Assessment in the Los Angeles Metropolitan Area.* Grant through the National Science Foundation's Graduate Research Fellowship Program: 3 years Tuition and Stipend.

- Reyna J (5/2012-8/2012) *Methodology for Assessing the Ecological Impacts of Building Construction Materials.* Grant through the National Science Foundation's Central Arizona-Phoenix Long-term Ecological Research Program: $2,500.

TEACHING

COURSES TAUGHT AT ARIZONA STATE UNIVERSITY

(⊞ denotes new course)

- Urban Infrastructure Anatomy and Sustainable Development (CEE486/494/598, CON598, SOS598, PUP598) ⊞
  Course taught in Spring 2014 and Fall 2012, 3 credits.
  Course evaluation: 4.35-5. Instructor evaluation: 4.89-5.
- Life Cycle Assessment for Civil Systems (CEE598, SOS598) ⊞
  Course taught in Spring 2014, Spring 2013 and Spring 2012, 3 credits.
  Course evaluation: 4.34-4.37. Instructor evaluation: 4.68-4.83.
- Transportation Systems Planning (CEE474)
  Course taught in Fall 2013.
- Sustainable Engineering Technical Writing (CEE474) ⊞
  Course taught in Fall 2013.
- Sustainable Engineering Journal Review (CEE598) ⊞
  Course taught in Fall 2012, 3 credits.
  Course evaluation: 4.92. Instructor evaluation: 4.4.
- Industrial Ecology and Design for Sustainability (CEE582, SOS515)
  Course taught in Spring 2012, 3 credits.
  Course evaluation: 3.5-3.57. Instructor evaluation: 3.81-4.28.

COURSES TAUGHT AT THE UNIVERSITY OF CALIFORNIA EXTENSION

- Energy Use and Climate Change
  Course taught Fall 2009, Summer 2010, and Fall 2010.
- Transportation Sustainability and Life-cycle Assessment
  Course taught Fall 2009, Summer 2010, and Fall 2010.

ADVISING

POST-DOCTORAL

- Susan Spierre Clark (advised from August 2013 to present)
  Research Topic: *The Metabolism of Energy for Urban Transportation*
- Kullapa Soratana (advised in Summer 2012)
  Research Topic: *Environmental Assessment of Air and High-speed Rail Corridors*

CURRENT

- Daniel Burillo
  Completing a Ph.D. in Civil, Environmental, and Sustainable Engineering
  Research Topic: *Coupled Infrastructure and Emergent Behavior Systems for Urban Growth.*
- Janet Reyna
  Completing a Ph.D. in Civil, Environmental, and Sustainability Engineering
  Research Topic: A *Socio-technical Life-cycle Assessment Framework for Urban Buildings.*
- Mindy Kimball

Completing a Ph.D. in the School of Sustainability
Research Topic: *Breaking Automobile Use Path Dependency through Transportation Infrastructure Investment.*

- Andrew Fraser
  Completing a Ph.D. in Civil, Environmental, and Sustainability Engineering
  Research Topic: *Urban Transportation Infrastructure Design and Emergent Life-cycle Impacts and Behavior.*
- Matthew Nahlik
  Completing an M.S. in Civil, Environmental, and Sustainability Engineering
  Research Topic: *Integrated Transportation and Land Use Life Cycle Environmental Impacts Along Los Angeles' Orange BRT and Gold LRT lines.*
- Matthew Bartos (Member of the Barrett's Honors College)
  Completing a B.S. in Civil, Environmental, and Sustainability Engineering
  Research Topic: *Valuing the Water-Energy Nexus Future in Arizona.*

GRADUATED

- Andrew Kaehr
  M.S. (2013) in Civil, Environmental, and Sustainable Engineering
  Research Topic: *Environmental Life-cycle Assessment of Multi-modal Freight Operations in California.*
- Ashok Sekar, Co-chaired with Eric Williams (Rochester Inst. of Tech.)
  M.S. (2012) in Civil, Environmental, and Sustainability Engineering
  Research Topic: *Is Carbon Sequestration Good for the Environment?*
- Christopher Gino
  M.S.E. (2012) in Civil, Environmental, and Sustainable Engineering
  Research Topic: *Integrated Transportation and Land Use Life Cycle Environmental Impacts Along Phoenix's Light Rail Line*
- Melissa Bernardo
  M.S. (2012) in Sustainability from the School of Sustainability
  Research Topic: *Product Ecolabelling Criteria Using Life Cycle Assessment*

COMMITTEE PARTICIPATION

- Mili-Ann Tamayao (Ph.D. student, Carnegie Mellon University).
- Richard Rushforth (Ph.D. student, Arizona State University).
- Xi Zhao (M.S. student, Arizona State University).
- Scott Unger (M.S. student, Arizona State University).
- Aura Ontiveros (Ph.D. student, Arizona State University).
- Shahrzad Badvipour (Ph.D. student, Arizona State University).
- Rachael Nealer (Ph.D., 2012, Carnegie Mellon University).

PROFESSIONAL ACTIVITIES AND SERVICE

NATIONAL SERVICE

- Associate Editor for Elementa for the Sustainable Engineering knowledge domain March 2013 to present.
- Transportation Research Board's Committee participation:
  - Transportation and Sustainability (ADD40)
  - Environmental Impacts of Aviation (AV030)

ARIZONA STATE UNIVERSITY SERVICE

- School of Sustainability Graduate Committee (Fall 2012 to Spring 2014).
- Faculty search committee for Transportation Systems position in Civil, Environmental, and Sustainability Engineering (Fall 2012 to Spring 2013).

- Faculty search committee for Construction position in the School of Sustainable Engineering and the Built Environment (Spring 2012).
- Development of a Life Cycle Assessment curriculum with Philip White for Arizona State University graduate students (lca.asu.edu) (Fall 2012).

JOURNAL PEER-REVIEW

- *Environmental Research Letters*
- IEEE Systems Journal
- Journal of Industrial Ecology
- Journal of Infrastructure Systems
- Transportation Research Part A
- Transportation Research Part E
- Environmental Pollution
- Transport Policy
- Environmental Science & Technology
- ASCE Journal of Transportation Engineering
- International Association of Traffic and Safety Sciences (IATSS) Research
- International Journal of Life Cycle Assessment
- *Nature Climate Change*
- Transportation Research Board
- Landscape and Urban Planning
- Resource, Conservation, & Recycling
- Energies
- Journal of Environmental Management
- Environmental Research

PROFESSIONAL EXPERIENCE

PROFESSIONAL

- Duggan Rhodes Group, LLC., Pittsburgh, PA (5/2001-8/2004)
  Construction and Engineering Consultant
  - Performed Critical Path Method schedule analysis
  - Developed labor productivity analyses
  - Created cost estimations
  - Led the development of web-based applications for productivity assessments
- Youchak and Youchak, Inc., Pittsburgh, PA (6/2000-4/2001)
  Environmental Engineer
  - Assisted in the design of landfills and water systems
  - Project surveying
  - Completed equivalency reviews for material comparisons

CONSULTING

- Ikea and the World Wildlife Fund (1/2010-11/2010). Developed strategies for existing and new Ikea stores for shifting low-volume shoppers to public transportation.
- INEOS (6/2009). Developed a carbon balance for various waste pathways for a pilot waste-to-ethanol facility. Project supported a $30 million grant application to the USDOE that was awarded.
- Los Angeles County (5/2009-9/2009). Analyzed the environmental life-cycle impacts of biodegradable products to support county policy banning non-renewable plastics.
- National Renewable Energy Laboratory (6/2011-7-2011). Created an environmental life-cycle assessment of the manufacturing and operation of future US passenger vehicles.
- PHD Media (4/2008-11/2008). Created an Environmental Media Sustainability Index for the advertiser to evaluate the greenhouse gas life-cycle emissions associated with various advertising plans.
- Community Environmental Council (9/2006-11/2006). Developed a feasibility study for Santa Barbara County to deploy a waste-to-electricity facility.
- UN Global Compact on Transformative Thinking (8/2010-7/2011). Developed several environmental assessments including teleworking and alternative transportation vehicles and fuels to support transformative thinking workshops for the UN.

EXHIBIT 8

Pavement Impacts from Proposed Hickman Farms Egg Facility in Tonopah, Arizona by B. Shane Underwood, Ph.D.

Pavement Impacts from Proposed Hickman Farms Egg Facility in Tonapah, Arizona

1 Objective

The objective of the analysis described below is to determine the impacts from the proposed Hickman Farms facility on the section of Indian School Road that is located north of the proposed facility and travels in an east-west direction between 419th avenue and 411th avenue.

2 Site Description

The study section is a two lane rural roadway managed by the Maricopa County Department of Transportation (MCDOT). This road carries an average daily traffic of 450 vehicles (225 east and 225 west)[1,2]. Detailed truck analysis of this particular road does not exist, but based on MCDOT reported values for the overall average number of trucks using its roadways as well as industry convention, it is assumed that 5% of these vehicles (approximately 23 vehicles daily) are heavy trucks. The road is surfaced with a 3/8 in. chip seal (see Figure 1) from a point immediately east of 411th avenue until approximately 442nd avenue. Based on an onsite visit taken Sunday, May 25, 2014 the segment of roadway nearest the proposed facility consists of 2.5 inches of asphalt concrete (see Figure 2). To the east of the proposed facility, this structure likely exists until the end of the paved surface (east of 411th avenue), while to the west of the proposed facility the structure transitions to chip seal only before becoming unpaved (at approximately 442nd avenue). The support for the asphalt concrete layer is assumed to consist of 6 inches of compacted aggregate. Subgrade conditions are estimated to consist of AASHTO graded A-1 soil based on research published by the National Cooperative Highway Research Program[3]. A more in-depth forensic evaluation would be necessary to confirm the precise structure present.

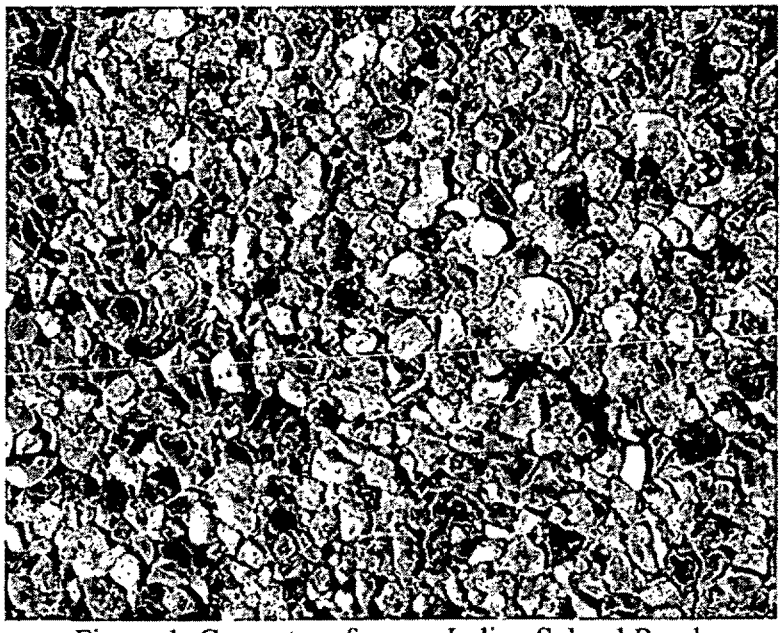

Figure 1. Current surface on Indian School Road.

Figure 2. Current pavement structure for Indian School Road.

3 ROAD CONDITION

MCDOT currently rates this road segment as "Very Good" to "Good" meaning that its pavement condition rating has a value of 55 or higher (on a 0-100 scale). A more objective measure of quality is the International Roughness Index, which rates this pavement as "Rough" (IRI = 170-220 in/mile) to "Very Rough" (> 220 in/mile). These values are consistent with the existence of a chip seal[4]. Except for some flushing in the east-bound lane at the approach to the intersection with 411th avenue (see Figure 3), no large scale signs of distress are observed in the study section.

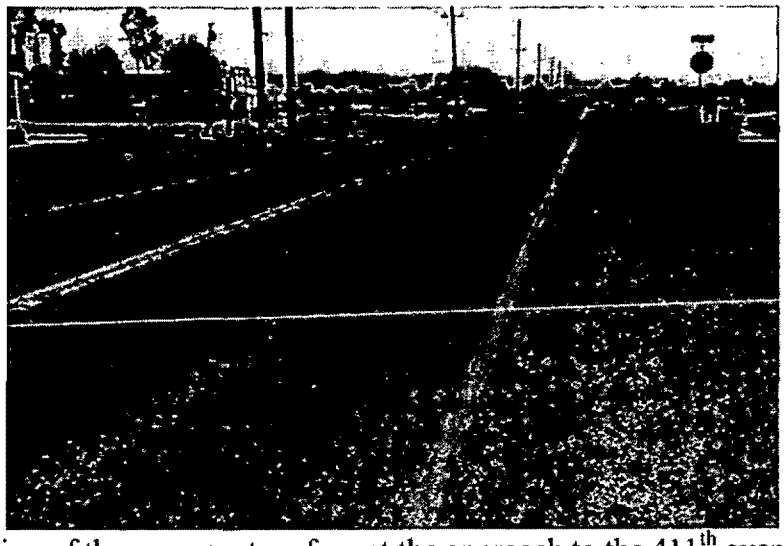

Figure 3. Flushing of the pavement surface at the approach to the 411th avenue intersection.

4 ANALYSIS SCENARIOS

Four alternatives were investigated for this analysis;

A do nothing or reference case where the proposed facility does not exist,
A facility housing 2.2 million birds (Scenario 1),
A facility housing 8 million birds (Scenario 2), and
A facility housing 12 million birds (Scenario 3).

The relevant input parameters for each scenario are summarized in Table 1 below. Justification for the proposed values is given below the table. Note that the facility owner has indicated that the manure and dead chicken may be combined into a single product for removal from the facility. In the analysis here the two are assumed to be removed separately. The final decision to combine or separate the manure and chicken will not change the results of this analysis since the weight needed for removal would remain the same.

Table 1. Summary of Conditions for Analysis Scenarios.

Detail	Scenario 1	Scenario 2	Scenario 3
# of Birds	2.2 million	8 million	12 million
Manure			
Weight (lbs/day)	330,000	1,200,000	1,800,000
Volume (trucks/day)	6.6	24	36
FHWA Classification	Type 9	Type 9	Type 9
Dead Chickens			
Weight (lbs/year)	3,441,429	12,514,286	18,771,429
Volume (trucks/day)	0.2	0.7	1.0
FHWA Classification	Type 9	Type 9	Type 9
Feed			
Weight (lbs/day)	350,000	1,266,864	1,900,000
Volume (trucks/day)	7	25.3	38
FHWA Classification	Type 9	Type 9	Type 9
Eggs			
Volume (trucks/day)	3.5	12.7	19
FHWA Classification	Type 8	Type 8	Type 8
Additional Daily Vehicles			
FHWA Class 9	13.8	50.0	75.0
FHWA Class 8	3.5	12.7	19
Bus	1	1	1
Passenger Cars	22	80	120

Manure:
The Midwest Plan Service MWPS-18, 2nd Edition (2005) Manure Characteristics reference (Table 6, Page 13) shows that an egg layer with an average weight of 3 pounds produces 0.15 pounds of manure per day.

$$Total\ Manure\ Weight\ (lbs) = Number\ of\ Birds \times 0.15$$

Assuming that the facility will be sending this manure to lands in the Southeast Valley using the fewest trucks possible requires a gross vehicle weight of 80,000 lbs (largest legal GVW in AZ). This weight would require a Federal Highway Administration Class 9 truck which has an approximate haul weight of 50,000 lbs per load.

$$Number\ of\ Manure\ Trucks\ (trucks\ per\ day) = \frac{Total\ Manure\ Weight\ (lbs)}{50{,}000\ (lbs)}$$

Dead Chickens:
Keeping the same average weight of 3 lbs for each chicken and assuming an average dead loss turnover of 100 weeks (Hickman's estimate is 90 – 110 weeks). Assume the same scenario as with manure and a per-load weight of 50,000 lbs produces the following number of averaged daily trucks. Note that for the pavement analysis an annualized average daily truck traffic follows convention, but this may not be applicable for analysis of other factors.

$$Number\ of\ Dead\ Chicken\ Trucks\ (trucks\ per\ 100\ weeks) = \frac{3\ (lbs) \times Number\ of\ Birds}{50{,}000\ (lbs)}$$

$$Number\ of\ Dead\ Chicken\ Trucks\ (trucks\ per\ year) = \frac{3\ (lbs) \times Number\ of\ Birds}{50{,}000\ (lbs)} \times \frac{365\ (days\ per\ year) / 7\ (days\ per\ week)}{100\ (weeks\ per\ cycle)}$$

$$Number\ of\ Dead\ Chicken\ Trucks\ (trucks\ per\ day) = \frac{Number\ of\ Dead\ Chicken\ Trucks\ (trucks\ per\ year)}{365}$$

Feed and Eggs:
Hickman's estimate (in transcript from Community Information Meeting, January 9, 2014) for the number of trucks is 1 truck per day per CAFO for feed and 0.5 truck per day per CAFO for eggs. Feed is assumed to arrive in a fully loaded FHWA class 9 truck whereas eggs are assumed to leave on a FHWA class 8 truck.

Additional Daily Vehicles:
One additional bus (to transport inmates to and from the facility) is projected in all three scenarios. Although their impact is small, employee related passenger car vehicles are also included.

Traffic Growth Rate:
For each scenario growth rates of 0% or 4% (no growth and conventionally assumed growth rate) are assumed. The use of a 4% growth rate is industry convention in the absence of other information.

5 SCENARIO ASSESSMENT

The adequacy of the pavement section is assessed with the 1993 American Association of State Transportation Officials (AASHTO) design guide and a design life of 20 years. The AASHTO method is the nationally accepted standard for pavement design. The AASHTO design method is also the one adopted by MCDOT. This design practice is based on calculating and selecting the appropriate Structural Number (SN), and for this analysis the coefficients chosen for the asphalt concrete and aggregate base are 0.42 and 0.12 respectively. These values are based on the MCDOT standard design practice[5]. The required SN for each design scenario is summarized in Table 2 along with the SN for the current pavement. A higher SN value requires a thicker section of asphalt concrete and so SN values lower than the current pavement design represent a structural deficiency. Cases where the current pavement design would be inadequate are highlighted in Table 2.

Table 2. Comparison of Current Structural Adequacy of the Study Section and the Structural Requirements of Different Analysis Scenarios.

Analysis Scenario	Structural Number
Current Pavement Design	1.77
Do-Nothing Scenario	1.43
	1.54
Scenario 1	1.80
	1.92
Scenario 2	2.14
	2.28
Scenario 3	2.27
	2.42

Based on the AASHTO 1993 design method, the current pavement is found to be insufficient to support traffic under all scenarios involving the proposed egg facility. Should any of the analysis scenarios occur the expected life of the existing pavement is less than 20 years:

- Scenario 1 – 18.6 years to 14.2 years
- Scenario 2 – 6.5 years to 5.9 years
- Scenario 3 – 4.5 years to 4.2 years

For this design assessment, values for truck factors have been taken directly from MCDOT design practice as follows:

- Existing background trucks = 1.2
- FHWA Class 9 trucks = 2.3187

- FHWA Class 8 trucks = 0.8646
- Bus = 0.6806
- Passenger cars = 0.0008

6 IMPACT ASSESSMENT

From the current MCDOT design standards the following design changes will be needed; an additional 0.5 inch of asphalt concrete will be required under scenario 1, an additional 1 to 1.5 inches of asphalt concrete will be required under scenario 2, and an additional 1.5 to 2 inches of asphalt concrete will be required under scenario 3. These values reflect standard practice to round the required thickness values up to the nearest 0.5 inch.

Failure to upgrade the facility could result in the development of pavement ruts (longitudinal depressions along the travel direction) or fatigue cracks (irregularly shaped cracking pattern starting in the wheel paths and eventually extending over the whole pavement surface). Based on a visual assessment of the roadway, nearby roads, and the traffic facilities in general within the central area of Arizona, cracking would likely be more prone to occur. Fatigue cracks can increase the overall pavement roughness and in extreme cases reduce the speed with which vehicles can manageably travel. They may also permit water to enter the pavement system degrading the pavement support further and also causing potholes. If rutting does develop it is most likely to occur nearest the intersection of Indian School Road and 411th avenue. In some cases this rutting can be associated with bleeding of asphalt cement to the surface, which will reduce the skid resistance and lengthen the required stopping distance for vehicles. Deep rutting that may develop away from the intersection could also pose a safety hazard since water can collect within the ruts during rain events and cause vehicles to hydroplane.

Given the geometry of the roadway (24 feet wide) and the distance from the proposed facility to the intersection with 411th avenue (1 mile), the costs of the additional asphalt concrete thickness would be substantial[5]. These costs would include at a minimum the cost of labor, material, and traffic control. If the new pavement were not constructed in a timely manner then it could deteriorate to a point where it would have to be removed prior to placing the new layers, which would add still additional costs to each scenario. In addition to the increased capital cost needed to bring the facilities to a sufficient structural capacity, there may be an increase in long term maintenance costs because of decreased performance life of any applied chip seals. However, the life of these maintenance strategies is too variable to provide justifiable estimates. Chip seals may also be prone to aggregate loss (called whip off), which can increase with vehicular forces (such as when heavier vehicles are used) or vehicular speed. While this aggregate loss is not generally substantial enough to cause bodily harm it can cause damage to the windshields and headlights of oncoming cars.

Overall based on this analysis, which includes facility size, growth scenarios, and productivity estimates provided by Hickman Farms, it is highly likely that the proposed facility will negatively impact Indian School Road. The above analysis was based on a scenario wherein Hickman Farms would deploy manure trucks with maximal loads. The analysis cannot guarantee that this is the strategy that Hickman Farms will deploy and if an alternative strategy is used then the exact impacts may change.

References

1. Arizona Department of Transportation (2014) "Transportation Data Management System." Online: <http://adot.ms2soft.com/tcds/tsearch.asp?loc=Adot&mod=>

2. Maricopa County Department of Transportation (2014) "Traffic Counts (I/J)." Online: <http://www.mcdot.maricopa.gov/technical/counts/counts/ijk_1.htm>

3. Zapata, C. and C.E. Cary (2012) "Integrating the National Database of Subgrade Soil-Water Characteristic Curves and Soil Index Properties with the MEPDG." National Cooperative Research Program, Transportation Research Board, National Research Council, Washington, D.C.

4. Maricopa County Department of Transportation (2012) "State of the Systems Report: Roadway Management System."

5. Maricopa County Department of Transportation (2013) "Roadway Design Manual: Chapter 10 Pavement Design Guide." Online: <www.mcdot.maricopa.gov/technical/eng-manuals/RdwyDesgnManual-112513.pdf>

CURRICULUM VITAE

B. Shane Underwood

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Civil, Environmental, and Sustainable Engineering
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Email: Shane.Underwood@asu.edu

EDUCATION

2011 Ph.D., Civil Engineering, North Carolina State University
2006 M.S., Transportation Materials, North Carolina State University
2003 B.S., Civil Engineering, North Carolina State University

ACADEMIC EXPERIENCE

2012-present	Assistant Professor, Arizona State University. School of Sustainable Engineering and the Built Environment. Civil, Environmental, and Sustainable Engineering.
2008-2012	Research Scientist, North Carolina State University. Department of Civil, Construction, and Environmental Engineering. Transportation Materials.
2003-2008	Graduate Research Assistant, North Carolina State University. Department of Civil, Construction, and Environmental Engineering. Transportation Materials.
2006-2007	Graduate Teaching Assistant, North Carolina State University. Department of Civil, Construction, and Environmental Engineering.
2001-2003	Undergraduate Research Assistant, North Carolina State University. Department of Civil Engineering. Transportation Materials.

AREAS OF EXPERTISE

Research

Pavement structural design; Pavement materials characterization and design; Performance modeling with constitutive techniques.

Teaching

Pavement design, Civil Engineering Materials, Advanced Asphalt Pavement Analysis, Inelastic Materials, Bituminous Materials, Summer Transportation Institute (K-12)

HONORS AND AWARDS

- University nomination for Council of Graduate Schools Dissertation Award in Mathematics, Physical Sciences, and Engineering, 2012
- University Outstanding Teaching Assistant Award, 2007-2008
- Mentored Teaching Assistantship, 2006
- Dwight D. Eisenhower Graduate Fellowship, 2006
- Ward K. Parr Association of Asphalt Paving Technologists Scholarship, 2005
- Dwight D. Eisenhower Graduate Fellowship (ranked number 1), 2004-2005

- Honorable Mention National Science Foundation Graduate Research Fellowship, 2004
- North Carolina State University Alumni Scholarship, 2003
- North Carolina State University Deans Fellowship, 2003

PUBLICATIONS

Bold represents students that I advised as a committee chair
Bold Italic represents other students that I mentored significantly
Italics represent post-doctoral researchers that I mentored
* represents author making the major contribution

Articles in Refereed Archival Journals

1. *Zeiada, W.A.**, B.S. Underwood, T. Pourshams, J. Stempihar, K. Kaloush (2014). "Comparison of Conventional, Polymer, and Rubber Asphalt Mixtures using Viscoelastic Continuum Damage Model," *Road Materials and Pavement Design*. In Press.
2. Underwood, B.S.* and *W.A. Zeiada* (2014). "Modeling the Microdamage Healing in Asphalt Concrete with a Smeared Continuum Damage Approach," *Transportation Research Record: Journal of the Transportation Research Board*. In Press.
3. *Zeiada, W.A.**, M. Souliman, K.E. Kaloush, M. Mamlouk, B.S. Underwood (2014). "Comparison of Fatigue Damage, Healing, and Endurance Limit using Beam Fatigue and Uniaxial Fatigue Tests," *Transportation Research Record: Journal of the Transportation Research Board*. In Press.
4. Underwood, B.S.* and Y.R. Kim (2014). "A Nonlinear Viscoelastic Constitutive Model for Asphalt Cement and Asphalt Mastic," *International Journal of Pavement Engineering*, In Press.
5. Underwood, B.S.* and Y.R. Kim (2014). "A Four Phase Micro-Mechanical Model for Asphalt Mastic Modulus," *Mechanics of Materials*, 75, pp. 13-33.
6. *Zeiada, W.A.**, K.E. Kaloush, B.S. Underwood, M. Mamlouk (2013). "Improved Method to Consider Air Void and Asphalt Content Changes on Long-Term Performance of Asphalt Concrete Pavements," *International Journal of Pavement Engineering*, 15(8), 718-730.
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8. Underwood, B.S.* and Y.R. Kim (2013). "Effect of Volumetric Factors on the Mechanical Behavior of Asphalt Fine Aggregate Matrix and the Relationship to Asphalt Mixture Properties," *Construction and Building Materials*, 49, pp. 672-681.
9. Underwood, B.S.* and Y.R. Kim (2013). "Microstructural Association Model for Upscaling Prediction of Asphalt Concrete Dynamic Modulus," *ASCE Journal of Materials in Civil Engineering*, 25(9), pp. 1153-1161.
10. Underwood, B.S.* and Y.R. Kim (2013). "Microstructural Investigation of Asphalt Concrete for Performing Multiscale Experimental Studies," *International Journal of Pavement Engineering*, 14(5), pp. 498-516.
11. Underwood, B.S.*, C.M. Baek, and Y.R. Kim (2012). "Use of Simplified Viscoelastic Continuum Damage Model as an Asphalt Concrete Fatigue Analysis Platform," *Transportation Research Record: Journal of the Transportation Research Board*, 2296, Washington D.C., pp. 36-45.
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13. Underwood, B.S.* and Y.R. Kim (2012). "Comprehensive Evaluation of Small Strain Viscoelastic Behavior of Asphalt Concrete," *ASTM Journal of Testing and Evaluation*, 40(4), pp. 99-110.
14. Tan, Y., L. Shan*, B.S. Underwood, and Y.R. Kim (2012). "Healing Characteristics of Asphalt Binder," *Construction and Building Materials*, 27(1), pp. 570-577.
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18. Underwood, B.S.* and Y.R. Kim (2011). "A Viscoelastoplastic Continuum Damage Model for Asphalt Concrete in Tension," *ASCE Journal of Engineering Mechanics*, 137(11), pp. 732-739.
19. Shan, L.*, Y. Tan, B.S. Underwood, and Y.R. Kim (2011). "Separation of Thixotropy from Fatigue Process of Asphalt Binder," *Transportation Research Record: Journal of the Transportation Research Board*, 2207, Washington D.C., pp. 89-98.
20. Underwood, B.S.*, and Y.R. Kim (2011). "Experimental Investigation into the Multiscale Behavior of Asphalt Concrete," *International Journal of Pavement Engineering*, Special Multiscale Modeling Issue, 12(4), pp. 357-370.
21. Underwood, B.S.*, T.Y. Yun, Y.R. Kim (2011). "Experimental Investigations of the Viscoelastic and Damage Behaviors of Hot Mix Asphalt in Compression," *ASCE Journal of Materials in Civil Engineering*, 23(4), pp. 459-466.
22. Underwood, B.S.*, Y.R. Kim, and J. Corley-Lay (2011). "Assessment of the Use of Automated Distress Survey Methods for Network Level Pavement Management" *ASCE Journal of Performance of Constructed Facilities*, 25(3), pp. 250-258.
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25. Hou, T., B.S. Underwood*, and Y.R. Kim (2010). "Fatigue Performance Prediction of North Carolina Mixtures Using the Simplified Viscoelastic Continuum Damage Model," *Journal of the Association of Asphalt Paving Technologists*, 79, pp. 35-80.
26. Underwood, B.S.*, Y.R. Kim, and M.N. Guddati (2010). "Improved Calculation Method of Damage Parameter in Viscoelastic Continuum Damage Model," *International Journal of Pavement Engineering*, 11(6), pp. 459-476.
27. Underwood, B.S.*, M.S. Sakhaei Far, and Y.R. Kim (2010). "Using Limited Purchase Specification Tests to Perform Full Linear Viscoelastic Characterization of Asphalt Binder," *ASTM Journal of Testing and Evaluation*, 38(5), pp. 558-567.
28. Yun, T.Y.*, B.S. Underwood, and Y.R. Kim (2010). "Time-Temperature Superposition for HMA with Growing Damage and Permanent Strain in Confined Tension and Compression," *ASCE Journal of Materials in Civil Engineering*, 22(5), pp. 415-422.
29. Sakhaei Far, M.S.*, B.S. Underwood, S.R. Ranjithan, Y.R. Kim, and N. Jackson (2009). "The Application of Artificial Neural Networks for Estimating the Dynamic Modulus of Asphalt Concrete," *Transportation Research Record: Journal of the Transportation Research Board*, 2127, Washington D.C., pp. 173-186.
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"Response and Fatigue Performance Modeling of ALF Pavements Using 3-D Finite Element Analysis and a Simplified Viscoelastic Continuum Damage Model," *Journal of the Association of Asphalt Paving Technologists*, 78, pp. 829-868.

31. Underwood, B.S.* and Y.R. Kim (2009). "Determination of the Appropriate Representative Elastic Modulus for Asphalt Concrete," *International Journal of Pavement Engineering*, 10(2), pp. 77-86.
32. Kim, Y.R., C. Baek*, B.S. Underwood, V. Subramanian, M.N. Guddati, and K. Lee (2008). "Application of Viscoelastic Continuum Damage Model Based Finite Element Analysis to Predict the Fatigue Performance of Asphalt Pavements," *KSCE Journal of Civil Engineering*, 12(2), pp. 109-120.
33. Underwood, B.S.*, Y.R. Kim, Y. Seo, and K.H. Lee (2008). "Development of ViscoElastoPlastic Continuum Damage (VEPCD) Model for Response Prediction of HMAs under Tensile Loading," *KSCE Journal of Civil Engineering* [*Korean Version*], 28(1), pp. 45-55.
34. Underwood, B.S.*, Y.R. Kim and M.N. Guddati (2006). "Characterization and Performance Prediction of ALF Mixtures Using a Viscoelastoplastic Continuum Damage Model," *Journal of the Association of Asphalt Paving Technologists*, 75, pp. 577-636.
35. Underwood, B.S.*, A.H. Heidari, M. Guddati, and Y.R. Kim (2005). "Experimental Investigation of Anisotropy in Asphalt Concrete," *Transportation Research Record: Journal of the Transportation Research Board*, 1929, Washington, D.C., pp. 238-247.
36. Underwood, B.S.* and Y.R. Kim (2003). "Determination of Depth of Surface Cracks in Asphalt Pavements," *Transportation Research Record: Journal of the Transportation Research Board*, 1853, Washington D.C., pp. 143-149.

Journal Publications in Review

Journal Publications in Preparation

1. Underwood, B.S.* and Y.R. Kim (2013). "Continuum Damage based Constitutive Model for Asphalt Binder and Asphalt Mastic," *International Journal of Damage Mechanics*
2. Salim, R., Underwood, B.S.* and Y.R. Kim (2014). "Identification of Air Void Content to use in Performance Tests with Asphalt Concrete," *International Journal of Pavement Research and Technology*.
3. *Zeiada, W.**, K.E. Kaloush, B.S. Underwood, and M.S. Mamlouk (2014). "Development of Uniaxial Test Protocol to Measure Fatigue Damage and Healing," *ASTM Journal of Testing and Evaluation*
4. Medeiros, M.S.*, B.S. Underwood, J.S. Daniel, and Y.R. Kim (2015). "Application of Simplified Viscoelastic Continuum Damage Model to Determine Fracture Parameters for Asphalt Concrete Mixtures," *Journal of the Association of Asphalt Paving Technologists*.
5. Baek, C.M.*, B.S. Underwood, Y.R. Kim, M.N. Guddati (2014). "Development of a Mechanistic-Based Tool for Predicting Top-Down Cracking of Hot Mix Asphalt Pavements," *International Journal of Pavement Engineering*.
6. Underwood, B.S. (2014). "Historical Perspectives and Developing Trends in Modeling of Bituminous Paving Materials," *Journal of the Mechanical Behavior of Materials*.

Book Chapters

1. Kim, Y.R.*, B.S. Underwood, G.R. Chehab, J. S. Daniel, H.J. Lee, and T.Y. Yun (2008) "Chapter 7. VEPCD Modeling of Asphalt Concrete with Growing Damage," In *Modeling of Asphalt Concrete*. Edited by Y.R. Kim, ASCE/McGraw Hill, pp. 163-203.

Book Chapters in Preparation

1. Underwood, B.S.* (2014) "Chapter 9: Multiscale Modeling Approach for Asphalt Concrete and its Implications on Oxidative Aging," In *Advances in Asphalt Materials*. Edited by Shin-Che Huang and Hervè Di Benedetto, Woodhead Publishing Limited.

Refereed Reports and Technical Manuals

1. Kaloush, K.E.*, G. Way, B.S. Underwood, J. Medina. (2013). "Binder Properties of RuBind Crumb Rubber Modified Binders." Final Report, Department of Roads, State of Rio de Janeiro, Brazil.
2. Roque, R.*, J. Zou, Y.R. Kim, C.M. Baek, S. Thirunavukkarasu, B.S. Underwood, and M.N. Guddati. (2010). "NCHRP 1-42A: Top-Down Cracking of Hot Mix Asphalt Layers: Models for Initiation and Propagation, Final Report." National Cooperative Highway Program. Washington, D.C.
3. Kim, Y.R.*, B.S. Underwood, M.S. Sakhaei Far, N. Jackson, J. Puccinelli. (2009). "LTPP Computed Parameter: Dynamic Modulus, Final Report." Project No. DTFH61-02-D-00139, Federal Highway Administration, Washington, D.C.
4. Kim, Y.R.*, J.E. Hummer, M. Gabr, D. Johnston, B.S. Underwood, D.J. Findley, and C.M. Cunningham. (2009). "Asset Management Inventory and Data Collection." North Carolina Department of Transportation. Raleigh, N.C.
5. Kim, Y.R.*, M.N. Guddati, B.S. Underwood, T.Y. Yun, V. Subramanian, S. Savadatti and S. Thirunavukkarasu. (2008). "Development of a Multiaxial VEPCD-FEP++." Final Report FHWA-HRT-08-073. Federal Highway Administration.
6. Kim, Y.R.*, M.N. Guddati, B.S. Underwood, T.Y. Yun, V. Subramanian, and A.H. Heidari (2005). "Characterization of ALF Mixtures Using the Viscoelastoplastic Continuum Damage Model: Final Report." Project No. DTFH61-03-H-00116, Federal Highway Administration, Washington, DC.

Non-Refereed Conference Publications

None

Innovation

Name	Year	Type	Description
Asphalt Pavement Hierarchical Analysis-Suite (ALPHA-F, ALPHA-MAT, and ALPHA-IDT)	2008 - 2013	Software	• Asphalt concrete mixture linear viscoelastic and VECD fatigue analysis package for use with the asphalt mixture performance tester (AMPT). • ALPHA-F is distributed by Instrotek Inc. as part of IPC Global's AMPT fatigue test system. • ALPHA-MAT is a research grade software • ALPHA-IDT is a version developed for the AASHTO Advanced Pavement Research Laboratory at the National Institute of Standards and used for the analysis of IDT data from AMPT test equipment.
LTPP* Artificial Neural Networks for Asphalt Concrete Dynamic Modulus Prediction (ANNACAP)	2010		• Dynamic modulus prediction program for materials contained in the LTPP database. • General purpose dynamic modulus prediction program incorporating an advanced neural network model and other existing analytical models.

		• Official LTPP product available for mass use by request (http://ltpp-products.com/).

Refereed Conference Publications

1. Underwood, B.S., W.A. Zeiada, and K. Kaloush (2014). Comparison of Hot Mix Asphalt Endurance Limit using NCHRP 9-44A Developed Methodology to Other Analytical Techniques, *International Conference on Perpetual Pavement*, 2014.
2. Underwood, B.S.* and Y.R. Kim (2014). "Structuralization as Characteristic to Link the Mechanical Behaviors of Asphalt Concrete at Different Length Scales," *Proceedings International Conference on Asphalt Pavements*, ISAP. Raleigh, North Carolina, June 2014.
3. Underwood, B.S.*, C.M. Baek, and Y.R. Kim (2014). "Effect of Asphalt Binder Oxidation on the Modulus of Asphalt Concrete Mixtures," *Proceedings International Conference on Asphalt Pavements*, ISAP. Raleigh, North Carolina, June 2014.
4. *Zeiada, W.A.**, B.S. Underwood, and K.E. Kaloush (2014). "Uniaxial Fatigue Testing of Diverse Asphalt Concrete Mixtures," *Proceedings International Conference on Asphalt Pavements*, ISAP. Raleigh, North Carolina, June 2014.
5. Underwood, B.S.* and **A. Gundla** (2013). "Evaluation of In-situ RAP Binder Interaction in Asphalt Cement Composites," *4th International Conference on Asphalt Materials*, ICAM. Guangzhou, China, November 2013.
6. *Zeiada, W.A.**, K.E. Kaloush, B.S. Underwood, and M.S. Mamlouk (2013). "Effect of Air Voids and Asphalt Content on Fatigue Damage Using the Viscoelastic Continuum Damage Analysis," *Proceedings 2013 Airfield and Highway Pavements Conference*, ASCE, Los Angeles, California.
7. *Zeiada, W.A.**, B.S. Underwood, T. Pourshams, J. Stempihar, and K. Kaloush (2012). "Comparison of Conventional, Polymer, and Rubber Asphalt Mixtures Using Viscoelastic Continuum Damage Model," *Proceedings of the 5th Asphalt Rubber Conference*, Munich, Germany, October 2012.
8. Baek, C.M.*, S. Thirunavukkarasu, B.S. Underwood, M.N. Guddati, and Y.R. Kim (2012). "Top-Down Cracking Prediction Tool for Hot Mix Asphalt Pavements," *Proceedings Pavement Cracking: Mechanisms, Modeling, Testing, Detection, Prevention and Case Histories*, Ed. T. Scarpas, N. Kringos, I.L. Al-Qadi, and A. Loizos. Delft, 2012.
9. Underwood, B.S.*, M. Eslaminia, S. Thirunavukkarasu, M.N. Guddati, Y.R. Kim (2010). "Asphalt Concrete Pavement Response and Fatigue Performance Modeling using Advanced Techniques," *Proceedings of the 11th International Conference on Asphalt Pavements*, ISAP, Nagoya, Japan, August 2010.
10. Underwood, B.S.*, T.Y. Yun, and Y.R. Kim (2010). "Comparison of Fundamental and Engineering Properties of Asphalt Concrete Mixtures Subjected to Compressive and Tensile Loadings," *Proceedings of the 11th International Conference on Asphalt Pavements*, ISAP, Nagoya, Japan, August 2010.
11. Underwood, B.S.* and Y.R. Kim (2009). "Analytical Techniques for Determining the Endurance Limit of Hot Mix Asphalt Concrete," *2nd International Conference on Perpetual Pavements*, Columbus, Ohio. September 30 – October 2009.
12. Underwood, B.S.*, Y.R. Kim, S. Savadatti, S. Thirunavukkarasu, and M.N. Guddati (2009). "Simplified Fatigue Performance Modeling of ALF Pavements using VECD+3-D Finite Element Modeling," *7th International RILEM Symposium on Advanced Testing and Characterization of Bituminous Materials*, Rhodes, Greece. May 2009.
13. Underwood, B.S.*, E.T. Hou, and Y.R. Kim (2009). "Application of Simplified VECD Modeling to the Fatigue Prediction of Asphalt Concrete Mixtures," *7th International RILEM Symposium on Advanced Testing and Characterization of Bituminous Materials*, Rhodes, Greece. May 2009.

14. Baek, C.*, B.S. Underwood, V. Subramanian, M.N. Guddati, Y.R. Kim, and K. Lee (2008). "Viscoelastic Continuum Damage Model Based Finite Element Analysis of Fatigue Cracking," *Proceedings Pavement Cracking: Mechanisms, Modeling, Detection, Testing and Case Histories*, Ed. I.L. Al-Qadi, T. Scarpas, and A. Loizos. Chicago, 2008.
15. Kim, Y.R.*, B.S. Underwood, S. Mun and M.N. Guddati (2006). "Perpetual Pavement Evaluation Using the Viscoelastic Continuum Damage Finite Element Program," *Proceedings of the 2006 International Conference on Perpetual Pavement*. Columbus, Ohio, September 2006.
16. Underwood, B.S.*, Y.R. Kim and G. Chehab (2006). "Viscoelastoplastic Continuum Damage Model of Asphalt Concrete in Tension," *Proceedings of the 10th International Conference on Asphalt Pavements*, ISAP, Quebec City, Quebec, August 2006.

PRESENTATIONS

Bold represents students that I advised as a committee chair
Bold Italic represents other students that I mentored significantly
Italics represent post-doctoral researchers that I mentored
* represents presenter (double italics = shared presentation)

Invited Talks National or International Meetings

1. "Research Needs Statements: The Foundation of Successful Proposals," Doctoral Student Research in Asphalt Materials and Mixtures Workshop, Annual Meeting of the Transportation Research Board, January 2014.
2. "Constitutive Modeling of Asphalt Concrete: A Multiscale Perspective," Harbin Institute of Technology, Harbin, China, November 2013.
3. "Uniaxial Fatigue Testing of Rubberized Asphalt Mixtures," Technical Advisory Board Meeting for Rubber Pavements Association, May 2013.
4. "Research Needs Statements: The Foundation of Successful Proposals," Doctoral Student Research in Asphalt Materials and Mixtures Workshop, Annual Meeting of the Transportation Research Board, January 2013.
5. "Enhancing the Durability of Asphalt Pavements: Use of Models to Enhance Durability," Workshop at Annual Meeting of the Transportation Research Board, January 2013.

Conference Presentations

1. Underwood, B.S.* and M. El Asmar* (2014). "Sustainable Construction Practices," *2013 Roads and Streets Conference*, American Council of Engineering Companies of Arizona, Tucson, Arizona, April 2014.
2. Underwood, B.S.* and M. El Asmar* (2013). "Sustainable Construction Practices," *2013 Arizona Pavements/Materials Conference*, Tempe, Arizona, November 2013.
3. Underwood, B.S.* and **A. Gundla** (2013). "Evaluation of In-situ RAP Binder Interaction in Asphalt Cement Composites," *4th International Conference on Asphalt Materials*, ICAM. Guangzhou, China, November 2013.
4. Underwood, B.S.* and Y.R. Kim (2013). "Micromechanical Modeling of Particle Concentration Effect in Asphalt Mastic to Consider Physico-Chemical Interaction," *2013 Petersen Asphalt Research Conference*, Western Research Institute, Laramie, Wyoming, July 2013.
5. Underwood, B.S.* (2013). "Use of Pavement Models to Evaluate Impacts of RAP in Pavement Construction," *2013 Airfield and Highway Pavements Conference*, ASCE, Los Angeles, California, June 2013.
6. Underwood, B.S.* and Y.R. Kim (2013). "Mechanistic Behaviors of Fine Aggregate Matrix and its Relation to Asphalt Mixture Behaviors" *2013 Airfield and Highway Pavements Conference*, ASCE, Los Angeles, California, June 2013.

7. Underwood, B.S.* (2013). "Emerging Methods of Asphalt Concrete Mixture and Pavement Analysis," *2013 Roads and Streets Conference*, American Council of Engineering Companies of Arizona, Tucson, Arizona, March 2013.
8. Underwood, B.S.* and Y.R. Kim (2012). "Experimental Investigation of Asphalt Concrete at Different Length Scales," *2012 Engineering Mechanics Institute Conference*, ASCE, South Bend, Indiana, June 2012.
9. Underwood, B.S.* and Y.R. Kim (2012). "Experimental Investigation into the Behavior of Asphalt Concrete at Different Length Scales," *2012 Engineering Mechanics Institute Conference*, ASCE, South Bend, Indiana, June 2012.
10. Underwood, B.S.* and Y.R. Kim (2011). "Experimental Investigation into the Behavior of Asphalt Concrete at Different Length Scales," *2011 Engineering Mechanics Institute Conference*, ASCE, Boston, Massachusetts, June 2011.
11. Underwood, B.S.* and Y.R. Kim (2009). "Asphalt Pavement Response and Fatigue Performance Prediction with Viscoelastic Continuum Damage Modeling Approach," *2009 Pavement Prediction Symposium: Validation of Predictive Models Using Full-Scale and Field Pavement Performance*, WRI, Laramie, Wyoming, July 2009.
12. Underwood, B.S.*, and Y.R. Kim, (2008). "Comparison of Automated and Manual Data Collection for Pavement Distresses," *National Workshop on Highway Asset Inventory and Data Collection*, NCDOT/FHWA/AASHTO, Research Triangle Park, North Carolina, September 2008.

Invited Talks Local Professional Meetings

1. "Emerging Products and Technologies," Arizona Pavements/Materials Workshop on Understanding Modified Asphalt Binder Technology, April 2014.
2. "Mechanistic-Empirical Pavement Design Guide (MEPDG) and Software Demonstration," Asphalt Pavement Design and Management Short Course Topic, Arizona Local Technical Assistance Program, May 2013.
3. "What Lies Ahead in Asphalt Pavement Technology," Arizona Department of Transportation Highway Materials Workshop – Asphalt Module, February 2013.
4. "Sustainable Highway Construction Practices – A National Perspective," Arizona Department of Transportation Resident Engineers Conference, November 2012 (coordinated talk with Dr. Mounir El-Asmar)

SPONSORED RESEARCH AWARDS/PROJECTS

EPA: Environmental Protection Agency
FHWA: Federal Highway Administration
HUD: Department of Housing and Urban Development
NCDOT: North Carolina Department of Transportation
NCE: Nichols Consulting Engineers
NCHRP: National Cooperative Highway Research Program
NCSU: North Carolina State University
NSF: National Science Foundation
ODOT: Oklahoma Department of Transportation
TAMU: Texas A&M University
UNH: University of New Hampshire
WRI: Western Research Institute

Funded Research Contracts

Sponsor	Title	Role	Period	Total	Underwood's Portion
FORTA Corp.	Optimization of Fiber Blending and Testing Parameters for Poly-Aramid Blends Collaborator: ASU - Kamil Kaloush	PI	2013-2014	$ 79,686.00	$ 47,811.60
TAMU, ODOT	Selection of Long-Lasting Rehabilitation Treatment Using Life Cycle Cost Analysis and Present Serviceability Rating Collaborators: TAMU - Maryam Sakhaeifar (PI), David Newcomb, Tom Freeman	Co-PI	2013-2015	$ 234,477.00	$ 88,000.00
NCSU, NCHRP	Long-Term Aging of Asphalt Mixtures for Performance Testing and Prediction Collaborators: NCSU – Richard Kim (PI), Cassie Hintz; WRI – Michael Farrar; NCE – Kevin Senn	Co-PI	2013-2016	$ 800,000.00	$ 110,500.00
NUTC, UM	Impact of Freight Movement Trends on Highway Pavement Infrastructure Collaborator: ASU – Kamil Kaloush	PI	2014-2015	$ 40,000.00	$ 32,000.00
Total				$1,154,163.00	$ 278,311.60

Pending Research Proposals

Sponsor	Title	Role	Period	Total	Underwood's Portion
NSF	Impact of Nighttime Construction Operations on Asphalt Pavement Roughness Behavior Collaborator: ASU – David Grau	Co-PI	2014-2017	$ 326,139.00	$ 163,069.50
NCHRP	*Thermal Conductivity Measurement of Pavement* Materials Collaborator: ASU – Kamil Kaloush	PI	2014-2016	$ 166,837.00	$ 163,069.50
NCHRP	Probabilistic Decision Support Tool for Nighttime versus Daytime Construction Based on Asphalt Roughness Evolution Impacts Collaborator: ASU – David Grau	Co-PI	2014-2016	$ 223,253.00	$ 111,626.50
Total				$716,229.00	$ 437,765.50

Unsuccessful Research Proposals

Sponsor	Title	Role	Period	Total	Underwood's Portion
EPA	Modeling Environmental Exposure through Building-Environmental Interactions for Healthier Native American Schools Collaborators: ASU – Zhihua Wang (PI), Mounir El Asmar, Kamil Kaloush, Jim Anderson, Peter Hyde	Co-PI	2014-2017	$ 999,050.00	$ 159,848.00
NSF	CAREER: Investigating Micro- to Macroscale Linkage Mechanisms in Asphalt Concrete	PI	2014-2019	$ 400,008.00	$ 400,008.00
NCHRP	NCHRP Synthesis 20-05/Topic 45-15 Fiber Additives in	PI	2013-	$ 35,000.00	$ 31,500.00

	Asphalt Materials Collaborator: ASU - Kamil Kaloush		2014		
HUD	Construction Materials Decisions to Provide Sustainable Community Development Collaborators: ASU – Kamil Kaloush, Zhihua Wang, Mounir El Asmar	PI	2014-2017	$ 125,000.00	$ 32,500.00
NSF	Understanding the Impact of Microfibrillation on Microdamage Growth in Fiber Reinforced Asphalt Concrete	PI	2013-2017	$ 300,028.00	$ 300,028.00
NCHRP	Fiber-Reinforced Asphalt Concrete, Identification of Fiber Introduction Technique at the Asphalt Plant to Improve Fiber Distribution and Mixture Consistency Collaborator: ASU – Kamil Kaloush	PI	2013-2015	$ 179,949.00	$ 76,479.60
NCDOT	Local Calibration of MEPDG for Jointed Concrete Pavements in North Carolina Collaborator: NCSU – Mervyn Kowalsky	PI	2011-2013	$ 244,000.00	$ 163,480.00
NCDOT	Quantifying Dowel Bar Misalignment Collaborator: NCSU – Mervyn Kowalsky	PI	2010-2012	$ 255,000.00	$ 170,850.00
NCHRP	Guidebook for Selecting and Implementing Sustainable Highway Construction Practices Collaborators: ASU – Mounir El Asmar (PI), Allan Chasey, Michael Mamlouk, AMEC – Douglas Hanson, Ed Latimer	Co-PI	2013-2015	$ 474,202.00	$ 189,680.80
NCHRP	Simple Performance Test to Evaluate Crack Resistance and Growth Rate in Asphalt Mixtures Collaborator: ASU – Kamil Kaloush	Co-PI	2013-2015	$ 110,932.00	$ 47,966.00
NCHRP	A Mechanistic-Empirical Model for Top-Down Cracking of Asphalt Pavement Layers Collaborators: Kamil Kaloush (PI), Michael Mamlouk, George Way	Co-PI	2012-2014	$ 500,000.00	$ 149,991.00
Total				$3,623,169.00	$1,722,331.40

Research Contracts as Research Scientist

Sponsor	Title	Role	Period	Total	Underwood's Recognition
NCDOT	MEPDG Inputs for Warm Mix Asphalts	Co-PI	2011-2013	$ 281,273.00	$ 21,764.00
NCHRP	Performance-Related Specifications for Asphaltic Binders Used in Preservation Surface Treatments	Co-PI	2011-2013	$ 500,000.00	$ 10,739.00
KEC	Development of SMART Pavement Design Methodology	Co-PI	2010-2011	$ 62,675.00	$ 34,034.00
Total				$ 843,948.00	$ 66,537.00

Unsuccessful Research Proposals as Research Scientist

Sponsor	Title	Role	Period	Total	Underwood's Recognition
NCHRP	A Mechanistic-Empirical Model for Top-Down Cracking of Asphalt Pavement Layers	Co-PI	2012-2014	$ 500,000.00	$ 32,813.00
FHWA	Enhanced Analysis of Falling Weight Deflectometer Data	Co-	2010-	$ 353,575.00	$ 21,639.00

	for Use with Mechanistic Empirical Flexible Pavement Design and Analysis and Recommendations for Improvements to Falling Weight Deflectometer	PI	2012		
NCHRP	Validating an Endurance Limit for HMA Pavements: Laboratory Experiment and Algorithm Development	Co-PI	2009-2014	$ 750,000.00	$ 90,488.00
Total				$1,603,575.00	$ 144,940.00

Research Fellowships

Sponsor	Title	Period	Award Amount
FHWA	Dwight D. Eisenhower Fellowship: Viscoelastoplastic Continuum Damage Modeling of Modified and Unmodified Asphalt Mixtures	2004-2006	$ 60,800.00
NSF-REU	Surface Crack Depth Determination by Non-Destructive Means	2002	$ 1,500.00

Research Projects (Co-Investigator)

*Projects where contributions were made with no funding or some limited salary support, but where contributions lead to products, publications, or co-authored reports

Sponsor	Title	Period
FHWA, UNH	Evaluation of Plant Produced RAP Mixtures in the Northeast	2010-2012
NCDOT	Investigation of Primary Causes of Fatigue Cracking in North Carolina	2009-2011
FHWA	Hot Mix Asphalt Performance-Related Specifications Based on Viscoelastoplastic Continuum Damage Models	2008-2013
FHWA, TAMU	Multiscale Modeling of Asphalt Concrete for Fatigue Cracking Evaluation	2006-2011
NCDOT	Investigation of Highway Asset Inventory and Data Collection Methods	2008
FHWA	LTPP Computed Parameter: Dynamic Modulus	2007-2009
FHWA	Development of a Multiaxial VEPCD-FEP++ and Its Extension to the Indirect Tension Test	2005-2007
FHWA	Characterization of ALF Mixtures Using the Viscoelastoplastic Continuum Damage Model	2003-2005
FHWA	Evaluation of Plant Produced RAP Mixtures in the Northeast	2010-2012
NCDOT	Investigation of Primary Causes of Fatigue Cracking in North Carolina	2009-2011

TEACHING

Courses Taught

Term	Course Name	Course Number	Students	Student Evaluations[a]		
				Course Mean	Instructor Mean	Student Credit Hours
F13	Civil Engineering Materials[2]	CEE353	65			98
S13	Advanced Pavement Systems[2]	CEE598	8	4.34	4.87	24
F12	Pavement Analysis and Design[2]	CEE412	27	3.94	4.65	81
		CEE511	16	4.21	4.89	48
F07	Materials of Construction[3]	CE332	53	4.40	4.60	159

	Materials of Construction[3]	CE332	58	4.46	4.69	174
F06	Materials of Construction[3]	CE332	58	4.10	4.64	174

[1] New course to the University
[2] New/revised materials for an existing course
[3] Taught at other institution

New Courses Developed

Advanced Pavement Analysis Systems: This course covers classic and emerging methods of mechanistic analysis of flexible pavements. Specific learning objectives include:

1. Outline the mechanistic pavement analysis process in general terms
2. Calculate pavement performance using mechanistic and mechanistic empirical pavement analysis principles
3. Determine the stress/strain responses of linear viscoelastic materials to strain/stress input
4. Apply the uniaxial theory of linear viscoelasticity to asphalt concrete materials

The framework of mechanistic pavement analysis is first explained with the aid of the NCHRP developed mechanistic-empirical pavement analysis engine. Then, the students are introduced to linear viscoelastic analysis to prepare them for more advanced pavement analysis systems. Finally, advanced pavement analysis systems that incorporate more robust mechanistic models are discussed. Students carry out mini-projects for each topic and prepare a research paper detailing the use of advanced pavement analysis to solve an engineering problem.

STUDENT ADVISING

Current Advisees

- M.S. (Thesis option)
  - Akshay Gundla, "Effects of Recycled Asphalt Pavement Modification on the Rheological Behaviors of Asphalt Mastic", Spring 2014 (Expected)
- Ph.D.
  - Padmini Gudipudi, "Constitutive Modeling of Asphalt Fine Aggregate Matrix", Spring 2015 (Expected)
  - Ramadan Salim, Spring 2017 (Expected)

Graduated Advisees

- M.S.
  - Ryan Stevens, "Development of Laboratory Experiment to Evaluate Retroreflectivity of Lane Markings", Spring 2014(Expected)
  - Jose Medina, "Properties of Reacted and Activated Rubber (RuBind) Modified Binders", Spring 2014 (Expected)

Committee Member

- M.S.E. (Non-thesis option)
  - Jaesik Choi, In Progress
  - Erick Ponce, In Progress
  - Sam Enmon, Fall 2013
  - Onyekachi Chiadikobi Abarikwu, Spring 2013
  - Rohit Ramesh, Spring 2013

- Ph.D.
    - Ali Fakih, In Progress.
    - David J. Mensching (University of New Hampshire), "Developing an Index Parameter for Cracking in Asphalt Pavements using Viscoelastic Continuum Damage Principles", In Progress

Financial Support for Graduate Students

- Padmini Gudipudi, December 2014, PhD, Civil, Environmental, and Sustainable Engineering, Research Assistant.
- Akshay Gundla, May 2014, MS, Civil, Environmental, and Sustainable Engineering, Research Assistant.
- Ryan Stevens, December 2013, MS, Civil, Environmental, and Sustainable Engineering, Research Assistant.

PROFESSIONAL SERVICE

Editor or Associate Editor of Journal

None

Chair of University or College Committee

None

Member of University or College Committee

2012-Present New Faculty Cohort Steering Committee, IAFSE

Member or Chair of Department Committee

2013 SSEBE By-Laws Review Committee, Member
2012-Present SSEBE Laboratory Committee, Member

Organizer of National or International Meetings

2013 Co-Organizer, Hands-on Workshop on Plasticity, Sponsored by TRB AFK 50-1 Subcommittee on Modeling, Turner-Fairbank Highway Research Center, Washington, D.C.
2013 Co-Organizer, Student Poster Session at 2014 International Conference on Asphalt Pavement, Raleigh, North Carolina.
2011 Co-Organizer, Dallas Little Honorary Symposium at 2011 EMI Conference

Member of National or International Committee

2013-Present Member, Technical Advisory Board, Rubber Pavements Association.
2013-Present Scientific Committee, Transportation and Development Institute, 2nd Congress on Integrated Transportation and Development, St. Louis, Missouri.
2012-Present Scientific Committee, International Conference on Asphalt Pavement (ICAP), Raleigh, North Carolina
2012-Present Member, AFK 50: Characteristics of Asphalt Paving Mixtures to Meet Structural Requirements Committee at TRB

Office of National or International Professional Committee

None

Continuing Education Courses

April 2014	2014 NSF Career Proposal Writing Workshop
March 2014	How to Actively Engage your Students: A Workshop on Active Learning
Dec. 2013	National Science Foundation Day
March 2013	MGE@MSA Faculty Doctoral Mentoring Institute Certification
Jan. 2011	Introduction to Faculty Careers: A Workshop for Graduate Students and Postdoctoral Fellows
June 2009	American Concrete Pavement Association Professor's Seminar, Chicago, Illinois

Fundraising

None

External Program Reviews

None

Professional Memberships

2011-Present American Society of Civil Engineers, Associate Member

Member of Local Committee

2012-Present Member, Executive Committee, Asphalt Materials and Paving Conference, Tempe, Arizona.

Reviewer

2014	Journal of Zhejiang University-Science A
2013	Canadian Journal of Civil Engineering
2013	Journal of Composite Materials
2013	Mechanics of Materials
2012	International Journal of Pavement Research and Technology
2012-Present	Construction and Building Materials
2012-Present	ASCE Journal of Engineering Mechanics
2011-Present	ASCE Journal of Materials in Civil Engineering
2011-Present	Association of Asphalt Paving Technologists
2011	Environmental Science and Technology
2007-Present	International Journal of Pavement Engineering
2007-Present	Transportation Research Record: Journal of the Transportation Research Board

EXHIBIT 9

U.S. EPA in 2006 by the Environmental Integrity Project

March 27, 2006

Mr. Thomas P. Dunne
EPA Headquarters
Ariel Rios Building
1200 Pennsylvania Avenue, N. W.
Mail Code: 5101T
Washington, DC 20460

RE: Docket ID No. EPA-HQ-SFUND-2005-0013
Poultry Petition for Exemption from EPCRA and CERCLA
Reporting Requirements for Ammonia Emissions

Dear Mr. Dunne:

The Environmental Integrity Project submits the following comments in opposition to the poultry producers' petition ("Poultry Petition") for exemption from the reporting requirements under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Emergency Reporting and Community Right to Know Act (EPCRA). We submit these comments on behalf of our members and the Center for a Livable Future, Clean Water Action Alliance of Minnesota, Columbia Riverkeeper, Community Association for Restoration of the Environment, Environmental Defense, Family Farms for the Future, GRACE Factory Farm Project, The Humane Society of the United States, Institute for Agriculture and Trade Policy, Iowa Citizens for Community Improvement, Iowa Environmental Council, Izaak Walton League of America, Kentucky Waterways Alliance, Inc., Minnesota Center for Environmental Advocacy, National Catholic Rural Life Conference, Natural Resources Defense Council, Northwest Environmental Defense Center, Ozark Clear Water, Save The Valley, Sierra Club, Southern Environmental Law Center, Union of Concerned Scientists, Waterkeeper Alliance, Rolf Christian, Dean & Sue Jarrett, Robert E. Rutkowski and Sacoby Wilson M.S., Ph.D from the Center for Social Epidemiology and Population Health. We urge you to continue to require hazardous release reporting under these statutes from large poultry operations that release ammonia or other hazardous substances at levels that may jeopardize public health.

There are several significant problems with the Poultry Petition. First, the Poultry Petition ignores the ever-growing body of science that suggests that ammonia emissions from poultry operations have human health or environmental impacts that warrant emergency response. Second, an exemption would be at odds with the goals of EPCRA and CERCLA by depriving the government of information it needs to protect natural resources, and by exposing the public to potentially dangerous quantities of hazardous pollutants. Third, an exemption would leave ammonia emissions from poultry operations virtually unregulated, because EPCRA and CERCLA are necessary to address emissions of ammonia that would not otherwise be regulated under federal permitting statutes. Fourth, it would be arbitrary for EPA to grant the

petition, because it would be a departure from EPA's past positions on reporting exemptions. Finally, exempting poultry operations from EPCRA and CERCLA reporting requirements would prevent EPA from gathering critical data and would hamper its ability to ensure that emissions do not exceed harmful levels.

Instead of granting the Poultry Petition, EPA should protect rural residents by following the recommendations of the National Academy of Sciences. EPA should require poultry operations to use all of the currently available methods that are practicable to reduce ammonia emissions. EPA should also conduct an aggressive field program to monitor AFO ammonia emissions using a mass balance approach.

I. Structure of the Poultry Industry

Changes in the structure of the animal agriculture industry over the past few decades have generated a need for increased attention, not less, to the industry's impacts on the environment. Today, integrated livestock production is a multi-billion dollar business. Unlike traditional livestock farms where the animals grazed on pastureland, a growing number of Animal Feeding Operations (AFOs) confine thousands, or even millions, of animals in closed buildings for most, if not all of their lives, where they are fed a regimented diet in a closely controlled indoor environment.[1] These large-scale, integrated operations differ radically from the traditional family farm. The scale of modern integrated poultry operations dwarf historic farming enterprises and bring with them environmental and public health risks of equal proportion.[2]

In the poultry industry, large confinement operations dominate production. In the first half of the twentieth century a farm might have housed 500 chickens or a larger one might have housed 1,400 birds.[3] Today, a "smaller" poultry operation can house a 25,000 bird flock at a time producing an average of 5.5 flocks and 125 tons of poultry waste per year.[4] Although broiler houses typically confine approximately 20,000 to 30,000 birds per house at any given time in closed buildings, complexes housing laying hens may have as many as 1.5 million birds.[5] Such large AFOs are highly specialized operations in which the operator closely regulates the animals' environment, food source, and water supply.

Industry has been shifting away from the typical, smaller operation of years past, often in response to an increasingly competitive marketplace, with animal production becoming consolidated in the hands of a few giant agribusinesses. For example, between 1982 and 1992, roughly 20% of broiler operations across the country closed their doors, while the number of chickens raised increased considerably. Newer, larger operations replaced the small producers that went out of business.[6] This trend towards fewer but larger operations, results in concentrations of "more manure nutrients and other waste constituents within some geographic areas. These large operations often do not have sufficient land to effectively use the manure as fertilizer."[7]

Over 90% of all chickens are raised under a contractual relationship with "integrated" production and processing companies. Under this arrangement, the agribusiness "integrator" contracts with a "grower" to produce chickens for slaughter by the integrator.

The integrator owns the chickens throughout the production process and supplies the bulk of the necessary inputs including feed and medication. The integrator also monitors the production operation and provides growers with detailed instructions regarding the day-to-day activities at the site.[8]

Integrated livestock production is big business. The poultry industry alone generated over $21 billion in on-farm revenue in 1997, with much of the production coming from corporate producers operating large AFOs.[9] Large agribusinesses realize the lion's share of the profits. For instance, Tyson Foods, the world's largest meat producer, enjoyed $26.4 billion in sales and realized $1.9 billion in gross profits in 2004.[10] Revenues and profits continue to grow each year.

II. Ammonia Emissions from Poultry Operations Have Public Health and Environmental Impacts That Require Emergency Response

The Poultry Petition makes no mention of the large quantities of ammonia that are released from poultry operations and ignores the public health problems stemming from these releases. The livestock sector produces an estimated 73% of all ammonia emissions nationwide.[11] Poultry operations are widely recognized as the leading source of ammonia releases within the livestock sector with individual poultry operations producing staggering quantities of ammonia gas.[12] For example, Buckeye Egg Farm's facility in Croton, Ohio emitted 1.6 million pounds of ammonia in 2003 or over 4,300 pounds per day – 43 times the reporting threshold under CERCLA and EPCRA.[13] By comparison, Climax Molybdenum, a chemical manufacturer in Fort Madison, Iowa, reported to the Toxic Release Inventory (TRI) that it released 800 tons or 1.6 million pounds of ammonia—a figure identical to Buckeye Egg's annual releases. Climax Molybdenum was ranked ninth in the nation among manufacturers for point source releases of ammonia.[14] TRI data for 2003 reveals that Ohio Fresh Eggs' facilities are also among the top ammonia emitters in the country.[15]

Although few large poultry confinement operations have been willing to measure their ammonia emissions, there are many facilities that are likely exceeding the 100 pound per day reporting threshold under CERCLA and EPCRA. Recent studies suggest that layer operations with more than 44,000 birds and broiler operations with more than 49,000 birds may trigger the reporting requirements.[16] According to the most recent census data, there are more than 800 layer operations in the country that house more than 50,000 birds; 498 of these operations house more than 100,000 birds.[17] The census data also reveals that there are more than 25,000 broiler operations that have sold more than 60,000 birds.[18]

Ammonia is a human toxin that EPA lists alongside arsenic, cyanide, and benzene as hazardous substances under CERCLA. 40 C.F.R. § 302.4. Human exposure to ammonia triggers respiratory problems, causes nasal and eye irritation, and in extreme circumstances is fatal.[19] Ammonia concentrations of greater than 100 ppm have been regularly reported in poultry confinement operations,[20]with maximum concentrations reaching over 200 ppm.[21] These concentrations exceed virtually every recognized safety threshold for ammonia exposure, ranging from the reference concentrations of 0.144 ppm established by the EPA for community exposure to the time weighted average exposure limit of 25 ppm set by the National Institute for Occupational Safety and Health.[22]

Downwind neighbors are exposed to elevated ammonia levels, as well as other pollutants. For example, the Iowa Department of Natural Resources has been documenting ambient ammonia levels near poultry operations since 2003. In 2003, readings were as high as 750 ppb, in 2004, 481 ppb, and in 2005, 454 ppb.[23] These levels well exceed the recommended community exposure limit of 150 ppb and indicate that a public health hazard existed at the time the data was acquired.[24] EPA's ambient ammonia measurements taken at Buckeye Egg in Ohio also exceeded the public health limit, ranging from 151.5 ppb to 1,674 ppb (overall average of 407.5 ppb).

Public health standards, like the 150 ppb standard, are more conservative than the worker health standards that Poultry Petitioners rely on, because "the public includes sensitive individuals such as children, the elderly, and people with medical conditions."[25] However, ammonia emissions certainly affect non-sensitive persons as well. While taking ammonia measurements at Buckeye Egg, EPA's Environmental Protection Specialist experienced "personal discomfort from exposure to ammonia in the air" including watery eyes and "respiratory irritation."[26] *He left the site "wondering if [he] could tolerate continued exposure* and suspecting that residents...some 260 meters farther downwind, were also being fumigated by the ammonia plume."[27]

Ammonia is not only a human toxin but also contributes to the development of fine particulate matter which causes significant health problems, including aggravated asthma, difficult or painful breathing, chronic bronchitis, decreased lung function, and premature death.[28] Fine particulate matter has been linked to increased hospital emissions and emergency room visits for people with heart and lung disease, and decreased work and school attendance.[29]

Finally, ammonia emissions compromise the health of the birds themselves, reducing animal welfare and, in some instances, threatening public health. Poultry exposure to ammonia has been linked with high levels of contact dermatitis, such as foot, hock, and breast burns. Their risk of developing these conditions has become much more common over the past thirty years[30] and is exacerbated by the extreme stocking densities common to industrialized poultry facilities. Ammonia can also cause gastrointestinal irritation, respiratory problems, and lesions on the trachea and lungs, increasing their susceptibility to bacterial infections, which can have human health implications.[31]

These risks to public health led the American Public Health Association to call for a moratorium on new concentrated animal feeding operations "until scientific data on the attendant risks to public health have been collected and uncertainties resolved."[32] The Michigan State Medical Society, the Canadian Medical Association, as well as local boards of health, have also called for moratoria on new concentrated animal feeding operation construction.[33]

In addition to adverse health effects, ammonia emissions from poultry operations can pollute surface waters and harm the environment. Emissions of nitrogen to the atmosphere and to water are not independent effects. The residence time for ammonia in the atmosphere ranges from as little as hours to as long as days.[34] Ammonia and ammonium salts are water soluble and

can be deposited by wet deposition during precipitation.[35] Otherwise, gaseous ammonia and ammonium salts may be adsorbed to particulate matter and deposited during dry periods due to gravity.[36] *Deposition of atmospheric ammonia can cause eutrophication of surface waters by* accelerating vegetative growth, which chokes aquatic life.[37]

Volatilized ammonia affects local water bodies, as well as water bodies that are hundreds of miles from the site of origin. For example, ammonia emissions from Midwest agricultural operations may contribute to the eutrophication of the Gulf of Mexico.[38] Peer-reviewed research has documented that substantial ammonia emissions from commercial chicken houses on the Delmarva Peninsula could represent a significant source of nutrient nitrogen to the Chesapeake Bay through atmospheric deposition.[39] However, the Chesapeake Bay is also likely receiving ammonia deposition from upwind areas with intensive agricultural operations, including Ohio and North Carolina.[40]

III. EPA Should Deny the Poultry Petition Because an Exemption Would Be Contrary to the Goals of CERCLA and EPCRA and At Odds with Court and EPA Decisions

CERCLA, which was enacted "in 1980...in response to the serious environmental and health risks posed by industrial pollution," must be interpreted liberally so as to accomplish its remedial goals.[41] The EPA states that "a major purpose' of section 103 is "to alert the appropriate government officials to releases of hazardous substances that may require rapid response to protect public health, and welfare and then environment."[42] As discussed above, poultry operations have released quantities of ammonia that well exceed the reporting threshold under CERCLA and EPCRA, as well as public health exposure limits. Granting the Poultry Petition would be contrary to the goals and spirit of CERCLA and EPCRA by leaving the government without information to protect public health, welfare and the environment from ammonia releases. In addition, an exemption would be contrary to past court decisions and EPA enforcement actions which have all required agricultural operations to report releases of ammonia emissions that exceed reportable quantities.

A. Courts and EPA Have Applied CERCLA and EPCRA Reporting Requirements to AFOs in the Way that Congress Intended

Many in the integrated livestock industry argue that Congress never intended to apply CERCLA and EPCRA requirements to animal agriculture. However, they cite to no authority for this claim. If Congress had intended such a result, it could have excluded animal production facilities, including poultry facilities, from the reporting requirements of CERCLA.[43] Instead, Congress only chose to exempt "the normal application of fertilizer" from the CERCLA definition of release,[44] and provided an exemption under EPCRA for reporting releases when the regulated substance "is used in routine agricultural operations or is a fertilizer held for sale by a retailer to the ultimate consumer."[45]

Courts have applied these exemptions to agricultural operations in the way that Congress intended. For example, a federal district court in Kentucky held that neither of the exemptions should apply to Tyson's poultry production operations. Tyson did not qualify for EPCRA's routine agricultural use exemption, because it did not store ammonia in the chicken houses for agricultural use, nor did it use the ammonia in an agricultural operation.[46] Rather, it used exhaust fans and vents to release the ammonia to the environment so that it would not kill the chickens. Tyson also did not qualify for CERCLA's normal application of fertilizer exemption, because they were not applying ammonia to farm fields as fertilizer when they vented it into the atmosphere.[47] As a result, the court concluded that EPCRA and CERCLA "clearly [do] not exclude the release of ammonia from chickens or livestock production operations, and as a result, Defendants are required to report releases that meet or exceed reportable quantities."[48] Other courts have also clarified that EPCRA and CERCLA reporting requirements apply to AFOs. For example, an appellate court held that Seaboard Farms, Inc. must report the aggregate ammonia releases from all of its waste pits and confinement buildings at its 25,000 head hog operation.[49]

EPA has also taken enforcement actions against AFOs for failing to report ammonia emissions. For example, in November 2001, the United States and Citizens Legal Environmental Action Network, Inc. settled a case against Premium Standard Farms, Inc. (PSF), the nation's second largest pork producer and Continental Grain Company. The settlement resolved numerous claims of violations, including the failure to report ammonia emissions under CERCLA and EPCRA.[50] Recent measurements taken pursuant to the settlement agreement reveal that PSF releases 3 million pounds of ammonia annually from the cluster of barns and lagoons at its Somerset facility.[51] This data does not include the ammonia gases released when liquid manure is sprayed on the company's nearby fields. These emissions make PSF the fifth largest industrial emitter of ammonia in the United States.

Based on the foregoing, if EPA grants the Poultry Petition, it will run contrary to past Court decisions which have all appropriately held that AFOs should report ammonia releases that exceed regulatory thresholds. Furthermore, EPA will be reversing prior positions that it has taken in enforcement cases.

B. CERCLA and EPCRA Fill Important Gaps in Permitting Statutes

The federal permitting statutes have not been effective at controlling AFO ammonia emissions; therefore, CERCLA and EPCRA are still necessary to fill critical gaps. Congress intended CERCLA to augment, not supplant, other federal statutes that fail to address hazardous substances. Section 102 of CERCLA specifically authorizes EPA to designate substances like ammonia that are not regulated under other federal statutes as hazardous if "when released to the environment [they] may present a substantial danger to public health or welfare or the environment..."[52]

CERCLA and EPCRA require the reporting of only non-federally permitted releases. Therefore, if a poultry AFO's ammonia emissions are authorized by a permit under another federal statute, it does not have to report these emissions. Releases that are federally permitted are exempt not only from CERCLA and EPCRA notification requirements but from CERCLA liability as well.[53] However, even if a facility were to have a federal permit, the permit would not necessarily address all of the ammonia releases. A Clean Water Act permit, for example, would not address releases of ammonia to the air and, conversely, a Clean Air Act permit would not address releases of ammonia to water. Furthermore, not all statutes regulate the same chemicals. For example, the Clean Air Act does not regulate ammonia as a hazardous air pollutant.

In addition, many AFOs have not been permitted under the Clean Water Act or Clean Air Act. For example, no AFO has ever obtained a Clean Air Act permit, and some states have exemptions in place that specifically exempt agricultural operations from clean air act permitting requirements. Although the Clean Water Act has required large livestock operations (CAFOs) to obtain permits for more than 30 years, noncompliance has been widespread. In 2001, EPA estimated that at least 13,000 concentrated animal feeding operations were required to have Clean Water Act permits, but EPA and States had issued just 2,520 permits.[54] Some of the states with the highest numbers of poultry operations have permitted the fewest numbers of CAFOs under the CWA. For example, Arkansas has only issued permits to 5% of its 2,110 CAFOs, and Iowa has only issued NPDES permits to 2% of its 1,859 CAFOs.[55]

A recent court decision which overturned certain provisions of EPA's CWA rules for CAFOs, may also result in fewer CAFOs being permitted under the CWA. In Waterkeeper v. EPA, the court ruled that CAFOs are not required to obtain NPDES permits unless there is an actual pollution discharge from a CAFO. EPA is revising its rules in light of the court's ruling; however some states and industry representatives have already taken the position that many CAFOs are now exempt from the requirement to apply for CWA permits. For example, the Des Moines Register quoted Mr. Gene Tinker of the Iowa Department of Natural Resources as stating that "[b]ecause Iowa law bars such discharges, virtually all confinement operations would be exempt from the EPA's rules under the court's ruling." See also Letter from American Farm Bureau Federation, et. al., to South Dakota Department of Natural Resources Regarding NPDES permitting after *Waterkeeper v. EPA* (Aug. 4, 2005) ("operators may manage their operations to avoid discharges and opt not to seek NPDES permit coverage knowing that they face potential enforcement penalties for any accidental discharges that occur despite their best efforts").

Based on the foregoing, EPCRA and CERCLA are necessary complements to federal permitting statutes to address emissions of ammonia that would not otherwise be regulated. Granting the petition will leave ammonia emissions from poultry operations virtually unregulated and will endanger public health, welfare and the environment.

IV. An Exemption for Reporting Ammonia Emissions Would Be Inconsistent with EPA's Standards for Granting Exemptions from Reporting Requirements

If EPA grants an exemption for ammonia releases from poultry operations, it would contradict its past positions on reporting exemptions. EPA has rarely granted exemptions from CERCLA and EPCRA reporting requirements. However, Poultry Petitioners rely on an exemption from CERCLA reporting requirements that EPA granted for releases of naturally occurring radionuclides in certain materials subject to the exemption (e.g., overburden and ores in the subject mining sectors, coal and coal ash).[56] In the Final Rule issuing the exemption, EPA explained that "[s]uch exemptions may be granted for releases of hazardous substances that pose little or no risk or to which a Federal response is infeasible or inappropriate."[57] Additionally, "[r]equiring reports of such releases would serve little or no useful purpose and could, instead, impose a significant burden on the Federal Response system and on the persons responsible for notifying the Federal Government of the release."[58] In response to public comment, EPA further concluded that the reporting exemptions would not undermine the development of public information or communities' ability to obtain information on hazardous substances.[59] None of these criteria justify a reporting exemption for ammonia releases from poultry operations as discussed below.

A. Ammonia Emissions from Poultry Operations Pose Great Risk to Public Health

As discussed above, ammonia emissions from AFOs pose great risk to public health. Human exposure to ammonia triggers respiratory problems, causes nasal and eye irritation, and in extreme circumstances is fatal.[60] Despite these documented impacts, Petitioners argue that ammonia emissions from poultry houses pose little or no risk to public health, because they are very quickly dispersed over time and distance. However, in the rule issuing the radionuclide exemption, EPA noted that "overall population risks or the potential to pose significant risks at great distances are not the most important factors in deciding whether a CERCLA response action may be needed at any individual site."[61] Rather, an important determination of the need for response is the risk to "reasonably maximally exposed individuals" (i.e., workers or nearby individuals).[62] EPA and state measurements taken at poultry houses have exceeded both worker and community public health standards; therefore, it is absurd to argue that ammonia emissions from poultry houses pose little or no risk to public health.

B. Federal Response Actions Are Feasible and Appropriate

In the rule issuing the radionuclide exemption, EPA concluded that a CERCLA response would rarely, if ever, be necessary because the activities result in low-level, diffuse releases of radionuclides at concentrations that are near or at background. In addition, a response may not be feasible, because CERCLA response actions would not normally clean-up to below background levels. In contrast, a response may be appropriate when concentrations are likely to be elevated, and may be feasible where emissions are not diffuse and capable of being controlled

(*e.g.*, facilities that have "a point source release, as from an air vent," or a waste pile that could be covered).

In many cases, responses to ammonia emissions from poultry operations would be both appropriate and feasible. The ammonia emissions that EPA and states have taken at poultry operations reveal measurements well above natural background levels. Ammonia exists naturally in the air at levels between 1 and 5 ppb.[63] Thus, ammonia emissions from poultry operations like Buckeye Egg have exceeded natural background levels by more than 300 times the upper end of the range. In such cases, where ammonia levels exceed both natural background levels and public safety thresholds, a response is certainly appropriate and warranted.

CERCLA responses are also feasible for poultry operations that have elevated levels of ammonia. In fact, the National Academy of Sciences recommends that AFOs implement existing control strategies aimed at decreasing emissions now.[64] The most effective way to reduce ammonia emissions is to reduce the size of the operation, so that the amount of waste is reduced and more easily managed. In addition, there are many management practices that poultry operations can employ to reduce ammonia emissions from buildings, manure storage structures and from land application activities. Ammonia emissions from buildings, which are "point source releases," can be reduced by treating the air using washing walls or biofilters.[65] Biofilters have reduced ammonia emissions at AFOs by 65% to 80%.[66] Other methods to reduce ammonia include diet manipulation or adding enzyme additives to litter.[67] Covering manure storage structures, and composting solid manure will also reduce ammonia releases.[68] Directly injecting manure is the most effective way to control ammonia emissions during land application.[69] Some of these management practices in combination (e.g., diet, enzyme additives and injection) may reduce overall ammonia levels at poultry operations by more than 55 percent.[70]

In addition to requiring control technologies, other response actions, like monitoring nearby areas for exposure, would also be appropriate and feasible.[71] For example, EPA is requiring Buckeye Egg to monitor its ammonia emissions before and after implementation of an enzyme additive system.[72] Tyson is also commencing an ammonia monitoring project pursuant to a settlement, in addition to preparing a report on the available technologies for controlling ammonia from broiler houses and planting a tree barrier.[73]

C. Reporting Does Not Impose an Undue Burden on the Response System

Poultry Petitioners argue that the agencies will experience prophylactic, wide-spread reporting of ammonia emissions from poultry operations, thereby burdening the emergency response system. However, as EPA explained in its final rule describing the notification requirements, "[t]he government is not obligated to respond to every release to which it has authority to respond and therefore should not design a notification system on such a basis."[74]

EPA further explained that it is imperative for the Agency to have the information that it needs to assess whether a response is warranted:

> "Reportable quantities have been established so that the Agency is alerted promptly to situations that may warrant a government response. While EPA will not initiate a removal or remedial action for every release that is reported, EPA must obtain the information it needs to determine who has response authority, to assess whether there is a need for a federal response action, and to check that action is properly taken by others where appropriate." [75]

Unlike radionuclide releases at background levels where a response would rarely or never occur, agency responses to ammonia emissions from poultry operations may occur and indeed have occurred. Because recent measurements demonstrate that ammonia emissions from poultry operations continue to jeopardize public health, the importance of giving agencies access to information that allows them to address public health impacts outweighs any burden that comes from evaluating hazardous release reports.

D. Reporting Does Not Impose an Undue Burden on the Regulated Community

If EPA continues to require poultry operations to report ammonia emissions above reportable quantities, it will not place an undue burden on the regulated community. Although poultry operations are capable of measuring their emissions, CERCLA and EPCRA only require operations to estimate the quantity of ammonia releases. Recently, the NAS recommended development of mass balance models that would allow all operations to estimate their ammonia releases. Moreover, the administrative burden for reporting emissions is extremely low. For these reasons, EPA should deny the Poultry Petition.

1. *Poultry Operators are Capable of Estimating Ammonia Emissions*

According to the NAS, air pollution from livestock operations "warrant[s] serious attention to determine the effects of AFOs and to mitigate their detrimental effects."[76] In its report, the NAS was critical of EPA's approach of estimating emissions from livestock operations throughout the country, and recommended an alternative approach. Based on this criticism, the Poultry Petitioners argue that there is no generally accepted methodology for estimating the amount of ammonia emitted from poultry facilities. The NAS report, however, did not address compliance at the individual operation level and did not suggest that there is no reliable basis for regulatory action.

Estimating emissions across a broad array of animal operations is an entirely different matter than determining emissions at individual operations. As the EPA demonstrated in the Buckeye case, poultry house operations are simply the product of pollutant concentrations inside the buildings and the ventilation rate.[77] Consequently, poultry operators can readily determine the quantity of a release by multiplying the ammonia concentration by the ventilation rate.

According to the NAS, ammonia emissions can also be estimated using a mass balance approach.[78] The components of such a calculation, including purchased feed, nitrogen fertilizer, animal products produced, crops produced and manure exported, should be known by any competent producer. From a whole farm nitrogen balance calculation, the nitrogen input, output and unaccounted nitrogen can be determined. What remains to be determined is the relationship between this unaccounted nitrogen, and nitrogen lost as undesirable gases. Requiring the poultry industry to develop whole-farm nitrogen balances to reveal this relationship, instead of exempting them from regulation, will help EPA to obtain useful information about ammonia emissions. First, a reliable estimate of the magnitude of the nitrogen lost to the environment by livestock production will be developed. Second, the comparison of whole farm nitrogen balances with emission monitoring studies may uncover valuable relationships between emissions and control variables. Finally, whole farm nitrogen balances will help to corroborate the data generated from direct emissions determinations.

2. *The Administrative Burden of Reporting Ammonia Emissions is Low*

The level of administrative burden that arises from the reporting requirements under CERCLA and EPCRA is extremely low. Section 103 of CERCLA provides that any person in charge of a facility from which a hazardous substance has been released in a reportable quantity (RQ) must immediately notify the National Response Center ("NRC").[79] Releases of ammonia and hydrogen sulfide that exceed 100 pounds per day must be reported under section 103.[80] *One telephone call to the National Response Center fulfills the requirement to report releases of hazardous substances under CERCLA.*[81]

In addition to the reporting requirements under CERCLA, owners and operators of facilities must also provide immediate notice of the release of an extremely hazardous substance under EPCRA. Section 304(a) requires an owner or operator of a facility to report the release of an extremely hazardous substance to designated state and local officials, if "such release requires notification of section 103(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980."[82] *One telephone call to the appropriate state and local authorities also fulfills the initial requirement to report releases of hazardous substances under EPCRA.* In addition, the statute requires a written follow-up emergency notice to the state and local officials "as soon as practicable after the release" to update the initial notice's information. 42 U.S.C. § 11004 (a).

Section 103(f)(2) of CERCLA further provides for relaxed reporting requirements for continuous releases.[83] If a person can demonstrate that the releases are continuous or stable in quantity and rate, then notice of the release is only required to be given annually. Similarly, the regulations implementing EPCRA provide that reporting requirements do not apply to "[a]ny

release that is continuous and stable in quantity and rate under the definitions of 40 C.F.R. 302.8(b)." However, persons still have to provide the initial telephone notification required under Section 304(a) and (b) and the initial written notification under Section 304(c).

E. An Exemption Will Significantly Impact a Community's Right To Know About Hazardous Substances

If EPA grants the Petition, the communities that suffer from AFO pollution will be unable to obtain information about hazardous ammonia releases. Petitioners incorrectly assert that "ammonia release reporting would not serve as a useful source for public information." To the contrary, in most cases it is the *only* source of information. Unlike radionuclide releases, AFOs are not required to report ammonia releases pursuant to the community right-to-know reporting requirements, toxic release inventory requirements, and related provisions under EPCRA sections 311, 312, and 313. Therefore, a reporting exemption will significantly impact a community's ability and right to know about hazardous ammonia releases. As a matter of good public policy, "a community's right to know about pollution should always come before an industry's right to secrecy."[84]

V. Exempting Agribusinesses from EPCRA and CERCLA Requirements Would Prevent EPA from Gathering Critical Data

The NAS issued a report in 2003 in which it criticized EPA and USDA for not devoting the necessary technical or financial resources to estimate air emissions and to develop mitigation technologies.[85] In response to NAS concerns, EPA negotiated an Air Compliance Agreement with industry that establishes an emissions monitoring program.[86] Twenty-seven hundred participants have signed up for this agreement, including representatives of the poultry industry.[87] The stated purpose of the Agreement is to ensure that AFOs comply with applicable environmental requirements--including CERCLA and EPCRA requirements--and to gather scientific data that the Agency needs to make informed regulatory and policy determinations. Therefore, it would be arbitrary for the Agency to exempt poultry operations from EPCRA and CERCLA reporting requirements *before* it gathers the data it needs to quantify emissions coming from AFOs, particularly when the facilities already have a liability release.

Granting the Poultry Petition will not only remove incentives for facilities to participate in the monitoring study, but will also prevent government from having access to critical information about potentially dangerous releases. EPA agrees with this position. In response to amendment language that would have exempted AFOs from EPCRA and CERCLA reporting requirements, the Agency stated that if the amendment became law, many participants may withdraw from the Air Compliance Agreement, "because [they] signed up primarily based on the belief that they may currently trigger CERCLA and EPCRA ammonia emission reporting requirements."[88] Furthermore, "the proposed amendment would also affect a pending case that includes claims for violations of CERCLA reporting requirements at an AFO" thereby "hamper[ing] EPA's ability to obtain data regarding air emissions and to ensure that emissions do not exceed harmful levels."[89]

Conclusion

CERCLA and EPCRA provide an essential safety net for protecting water supplies and for protecting the air that we breathe. There is no compelling reason to exempt livestock facilities from these statutes when communities have been exposed to potentially dangerous quantities of hazardous pollutants from some large operations. Granting the Poultry Petition will leave agencies powerless to protect local communities by denying them access to critical information that they need to respond to hazardous levels of ammonia. Furthermore, it would deny communities the right to know about hazardous substances released by neighboring agricultural operations. Finally, companies that document their ammonia emissions are more likely to clean them up—both Buckeye and Tyson have taken steps to reduce ammonia to resolve violations of CERCLA and EPCRA reporting requirements.

Instead of granting the Poultry Petition, EPA should protect rural residents by following the recommendations of the National Academy of Sciences. EPA should require poultry operations to use all of the currently available methods that are practicable to reduce ammonia emissions. EPA should also conduct an aggressive field program to monitor AFO ammonia emissions using a mass balance approach.[90]

Sincerely,

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